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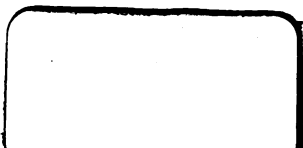
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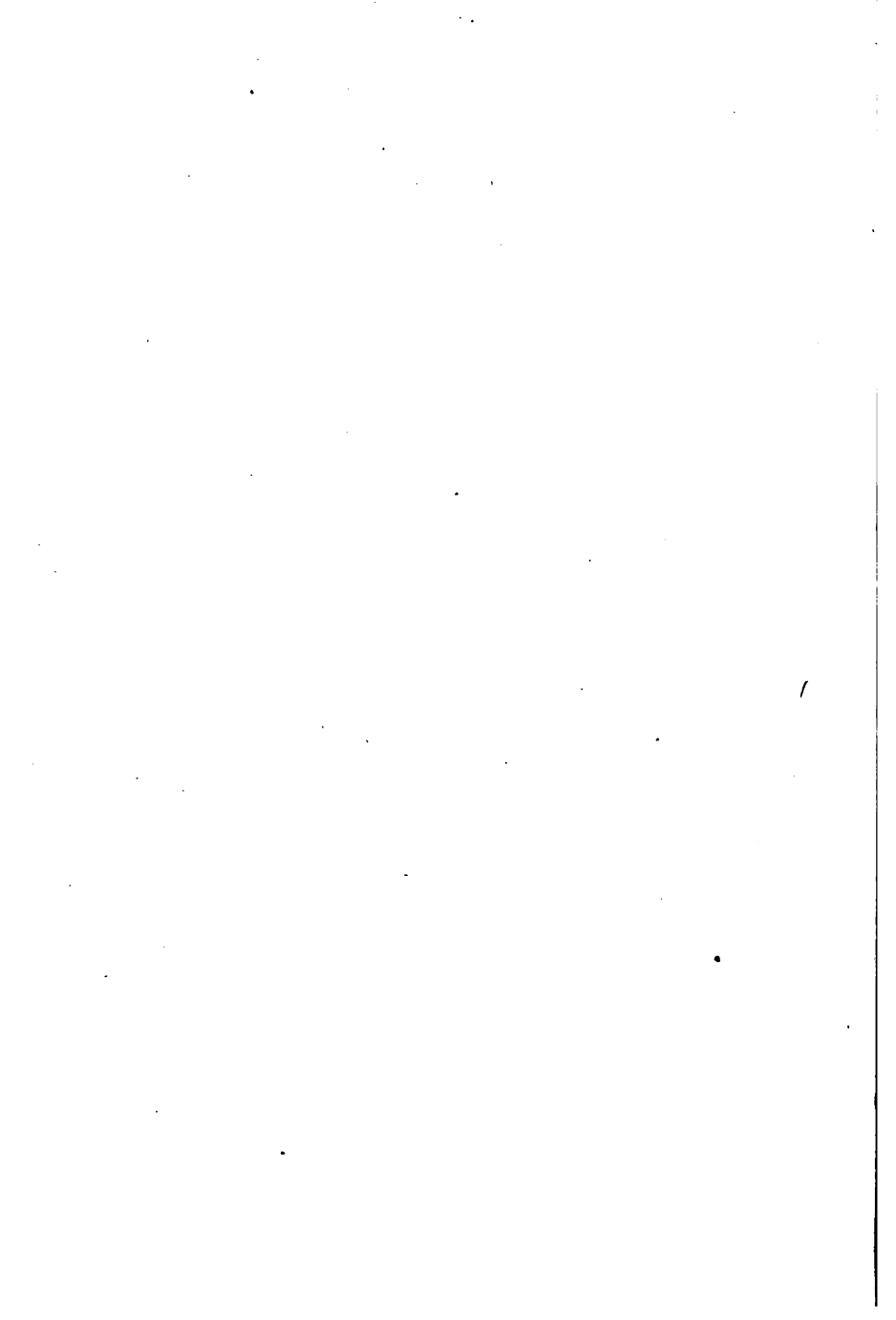




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HALF HOURS

WITH

FISHES, REPTILES, AND BIRDS

BY

CHARLES FREDERICK HOLDER

AUTHOR OF "ELEMENTS OF ZOÖLOGY," "STORIES OF ANIMAL
LIFE," "LIFE OF LOUIS AGASSIZ," ETC.



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FISHES, REPTILES, AND BIRDS.
W. P. 1

PREFACE

At the present day education is not complete without definite courses of nature study. We are living in an age of strenuous business life and activity, where the best equipped students along the various lines secure the best positions. Time was when zoölogy, botany, and kindred nature studies were classed with music and the so-called dead languages, and were taken up as incidentals or were employed in "mind training"; but to-day there are a thousand branches of trade and commerce which require knowledge that can be obtained only through nature study.

It is not necessary that the student, unless he intends to be a teacher of science or a professional naturalist, should be able to pass examinations in the abstruse classification of animals or delve into difficult anatomical studies. What the average student needs is a broad and general idea of animal life, its great divisions, and notably the relationship of the lower animals to man in an economic sense, the geographical distribution of animals, etc. It is vastly more important for the coming lumber merchant to know the relationship which forests bear to the water supply, and to have a general idea of forestry and the trees which make forests, than to be able to recite a long formula of classification or analysis, of value only to the advanced student or specialist. The future merchant who is to deal in alpaca, leather, dye, skins, hair, bone products, shell, pearl, lac, animal food products, ivory, whalebone, guano, feathers, and countless other articles

derived from animals is but poorly equipped for the struggle for business supremacy if he is not prepared by nature study, nature readings, and other practical instruction along these lines.

It is believed to-day by those who have given the subject the closest attention that the initial move of the teacher should be to call the attention of the child to the beauties of nature, the works of the Infinite, and thus early inculcate a habit of observation. The toys of the kindergarten should be fruits, flowers, shrubs, trees, pebbles, and vistas of mountains, hills, lakes, and streams, and nature study in some form should be continuous in school life.

In the following readings the story of lower animal life has been presented on broad lines, divested of technicality, and at almost every step supplemented by forceful and explanatory illustrations as ocular aids to the reader. The subject has been divested of dry detail, and I have introduced notes and incidents, the results of personal observation and investigation in various lands and seas, and have given attention to the often neglected fauna of the Pacific coast as well as that of other regions.

While the volume is a supplementary reader, the matter is so arranged that it can be used by the teacher as a text-book, and the pupil who undertakes the various "half-hour readings" of this series will have covered in the main the ground of the ordinary text-book for intermediate grades in the form of readings. In a word, I have endeavored to make this volume a popular combined review and supplemental reader on the fishes, reptiles, and birds.

CHARLES F. HOLDER.

PASADENA, CALIFORNIA.

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HALF HOURS WITH FISHES, REPTILES, AND BIRDS

FISHES

THE BIRDS OF THE SEA

FISHES are the birds of the sea. How true this is can be appreciated by imagining that the ocean is the atmosphere, not a very difficult feat if we glance down into it from a glass-bottomed boat or watch the graceful play of fishes in an aquarium. The water seems to be the air through which the fish flies. See how it poises, the fins or wings waving to and fro with a gentle undulatory movement, preserving its balance perfectly; when alarmed, the fish darts forward with the velocity of an arrow and disappears.

The habits of fishes carry out the resemblance to birds. Some are the larks of the sea, as the sardines, menhaden, and bluefish. They are always in midwater, rarely resting upon the bottom, and probably sleep poised. Others resemble the land birds, as the domestic fowl, quail, turkey, and other poor fliers. Such are the flounder, which always lies on the bottom, the little toadfish, the horned shark, which coils up among the rocks and apparently goes to sleep, and many of the rays.

Fishes recall the birds in their habits of migration. They move north and south, in and out of deep water,

according to the season. The bluefish and many others swim off shore in winter. The dogfish appears on the New England coast in vast schools, without warning, in summer. On the coast of California the migrations of fishes are equally wonderful; the shore line is a great highway up and down which the vast schools move in spring and autumn. The yellowtail appears in March and remains until December, when it seeks deep water off the great submarine plateau. The flying fish moves north in April, and goes south in September, and many fishes migrate with all the regularity of birds.

In their food-taking habits the fishes resemble the birds. The sharks and dogfishes are the eagles and hawks of the sea. The mullet and sturgeon, groping in the mud for their food, recall the ducks. The stately barracuda poises in one spot just as the man-of-war bird rides the gale, holding its position for hours. The fishes build nests very similar to those of the birds. The nests of some, as the sunfish, resemble those of gulls, being mere hollows in the sand. Other fishes, as the paradise fish, with its bubble nest, remind us of the building habits of grebes, while the little nest of the stickleback is almost as complicated at times as that of the oriole.

Are not the fishes as beautiful as the birds? Observe the common goldfish or the blue or green parrot fishes. The plumage of the golden pheasant is not more resplendent, while the birds of paradise have gorgeous counterparts in the angel and coral fishes of the tropics, bedecked in lines of red, yellow, green, and many combinations of color and tone which make them the most conspicuous creatures of the sea. The fishes resemble the birds in

many other respects, and are often as wonderful in their structure; that they are not so thoroughly appreciated is probably because they are not so well known.

THE FRAME OF THE FISH

It has been seen that fishes resemble birds in many ways, yet this does not indicate an actual relationship. If

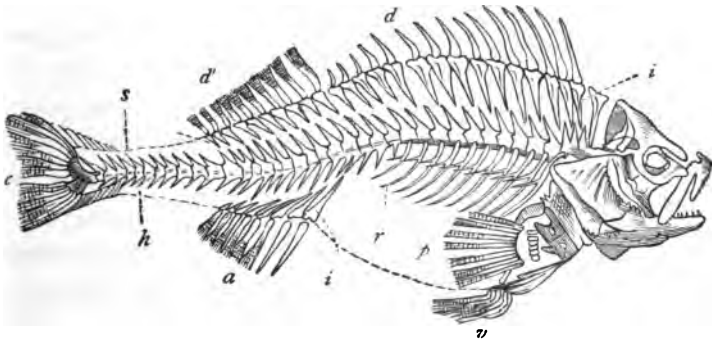


FIG. 1. — SKELETON OF THE COMMON PERCH (*Perca fluviatilis*).

p, pectoral fin; *v*, one of the ventral fins; *a*, anal fin, supported upon interspinous bones (*i*); *c*, caudal fin; *d*, first dorsal fin; *d'*, second dorsal fin, both supported upon interspinous bones; *i* *i*, interspinous bones; *r*, ribs; *s*, spinous processes of vertebrae; *h*, hæmal processes of vertebrae.

the skeleton of a bird is compared with that of a fish, but one striking point of resemblance will be found,—the backbone. Birds and fishes belong to the same great branch, the vertebrates, or backboned animals.

The reader has learned by experience that when eating fish he must avoid the bones. There are so many of them, they are so fine and so sharp, that one can almost believe that they must be a source of discomfort to the fish itself, yet on glancing at the skeleton of a fish (Fig. 1)

perch the tail is made up of an upper and lower blade of compact spines, which in the living fish are connected and webbed, forming a powerful organ, a perfect propeller which, in the case of the flying fish, with a screw-like twist hurls it into the air, and enables the active horse mackerel to take marvelous leaps. The tail is one of the most interesting organs of fishes, and it is well to note the remarkable difference in shape in various fishes.

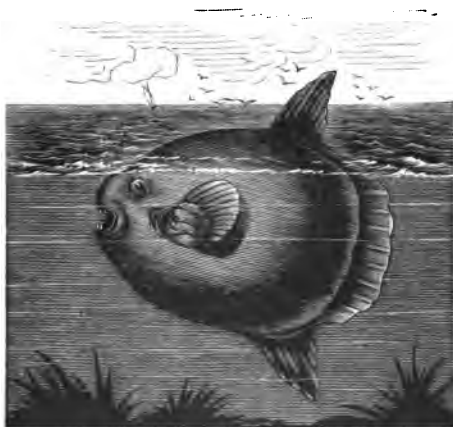


FIG. 2. — SUNFISH.

Perhaps the most singular is that of the sunfish (Fig. 2), which appears to be a mere rim of flesh; yet I have seen this fin twisted with a powerful screwlike motion, forcing the fish along. In some fishes the lobes are equal, as in the perch; but in the

Californian flying fish the lower lobe is the longer; in the sturgeon it is the upper lobe, the backbone extending out into it, as in fishes that lived in the very early days of the world. Each fin has its peculiar office, the dorsals and anals being centerboards or upright balancers to preserve the equilibrium of the fish. The pectorals or side limbs are balancers and locomotive organs, — actual feet in the case of the fish *Periophthalmus* (Fig. 39). The caudal fin or tail is a propeller and balancer, while the

hind legs or ventral fins, often immovable, are also balancers, or used as rests when on the bottom, or creepers, as in some sculpins, or suckers, as in the lumpfish and others.

The head or skull of the fish is made up of a complicated series of bones. The ear is internal, and over the mouth are found the nostrils; but the fishes can not breathe through them, as dogs and other animals can. They are for smelling alone, aiding the fish in discovering its prey. The orifices for the eyes are often large; the mouth is capacious, and in many instances capable of great distention. Around the jaws are the teeth. In the perch, the mackerel, and many fishes, they are very minute; in others, as the shark, in rows of twelve or more, all the rows except the outer being movable, so that when not in use they lie flat. Each tooth, in most species, has sawlike edges.

The teeth of fishes display a wonderful variety. Some, as in the Californian sheepshead and the hogfish, resemble those of a sheep, and project outward. Others, as in the great sunfish, form several long or ivorylike biting organs. The parrot fishes have veritable beaks.

The rays have crushers; the morays have fanglike teeth, recalling the snakes, while some low forms, like the lamprey eel, have a mouth which is a mere sucker (Fig. 3). The heads of fishes present remarkable variations in



FIG. 3.—MOUTH OF LAMPREY EEL.

the different kinds. In the Vomer, angel fishes, and others, it is very large in proportion to the body (Fig. 4), while the mouth is small. In the swordfish the upper jaw

is developed into a long mandible or sword, which can be thrust through the oaken sides of a ship. In the garfish both jaws are long, and armed with fine teeth. The upper jaw of the paddlefish is a spatula-shaped object. That

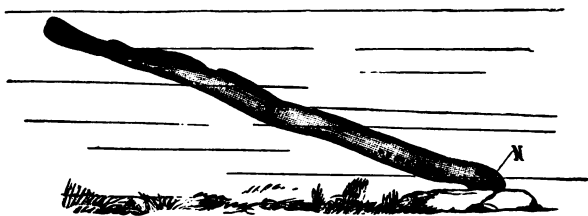


FIG. 4. — LAMPREY CLINGING TO A ROCK.

of the sawfish is a veritable saw, while the little Belone has its lower jaw elongated for some unknown purpose, and the snipefish has its mouth at the end of a long tube. A conspicuous feature of the head is what we may call the cheek, really the gill cover, a movable series of bones which cover and protect the gills (Fig. 6). -

Such, briefly described, is the frame of the fish. When clothed in the skin and fresh from the water the bones are concealed, the only suggestion being the rays which, covered with a delicate integument and connected by a web of flesh, appear in the fins. They look like delicate radiations or branches. The observer is first attracted by the scales which cover the fish, overlapping one another like shingles on a roof, forming a perfect armament. They appear to grow out of little pockets very much like finger nails. The peculiar slime with which fishes are covered exudes from beneath the scales, while a dark line which extends on both sides of the fish from head to tail, indi-

cates larger scales which are special lubricators or slime producers.

The scales of fishes, like the feathers of birds, give them beauty and their wealth of color (Fig. 5). In many they are of dazzling silver below, and blue or green above.



FIG. 5. — SCALES.

In the tarpon the scale is larger than a silver dollar, and has the appearance of molten silver. In the fresh-water garfish the scale resembles a china or flint plate. In the mackerel family they are very minute, while in the shark no trace of scales is seen, the animal being enveloped in a thick skin resembling sandpaper to the touch.

A LIVING MACHINE

If fishes are carefully watched in an aquarium, the cheek (Fig. 6) or gill cover, is seen rising and falling gently, while the mouth is kept slightly open. If one is taken from the water, this motion increases; the mouth opens in gasps, and the gill cover gapes wide, showing the red gills or lungs of the fish. At such times fishes undoubtedly suffer.

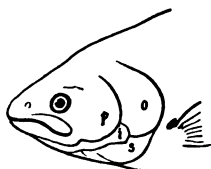


FIG. 6. — HEAD OF A FISH, SHOWING GILL COVER.

This gentle opening and closing of the gill cover is the breathing motion of the fish, and may be compared to

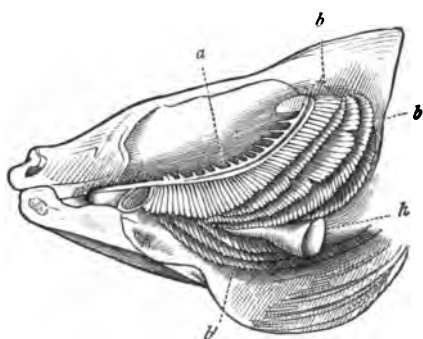


FIG. 7. — GILLS OF A FISH.

the rise and fall of the chest in human beings. The chest expands as we take air into the lungs, and the gill covers rise as water, laden with air, passes from the mouth to the gill chamber. By lifting the gill cover, the gills (Fig. 7) can be

seen — long slits with rough-toothed edges, to which are attached folds of vivid red flesh. The color is caused by innumerable blood vessels which permeate it and lie near the surface. The gills occupy a little room, its roof, the gill cover, and its doors, the gill opening and the mouth. In birds and other higher animals air is taken into the mouth and nostrils, reaching the lungs directly ; but the fishes, though air is necessary, do not require so much, and take delicate globules from the water. When the air supply in the water is exhausted, the fish dies. The fish in an aquarium rises to the surface, gasps, and shows its distress. Now, if air is forced beneath the surface, it immediately recovers.

To obtain air, the fish inhales water continually through the mouth and forces it in a never ending flow over the red gills and out at the gill openings ; so there is a constant stream flowing into what may be called the gill room. Now what occurs ? In answer glance at the

specimen, if one is at hand, or in default, at a drawing (Fig. 8). Here all the principal organs are seen. The one intimately connected with breathing is the heart, *c*, which is a marvelous pump, forcing the blood through various channels to the gills, *bt*, where it comes in contact with the air-laden water, absorbs the oxygen or air, and is purified or freshened. The fish takes air and water in at the mouth and its heart pumps the blood to the gills to

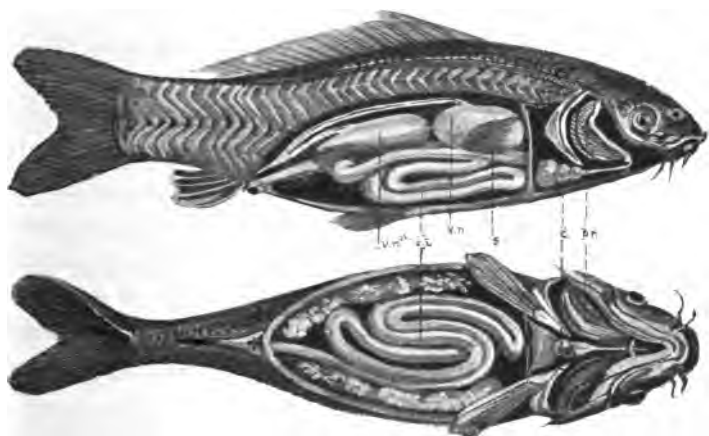


FIG. 8. — ANATOMY OF A FISH.

meet it, so that there is a constant flow of purified blood passing through the fish.

If it were possible to see the heart beat, it would be noticed that its motion is much more deliberate than that of the human heart. This is because the latter is a powerful four-chambered organ, while the heart of the fish possesses but two chambers, and forces the blood through the veins and arteries very slowly. The temperature of the blood, in consequence, falls very low in both

reptiles and fishes, in striking contrast to the rapid circulation in man and other mammals.

Watching a fish poised in its native element, rising or falling with the greatest ease, the observer may wonder that it does not sink, realizing that it is heavier than the water. The reason for its apparent buoyancy lies in a provision of nature,—a veritable balloon possessed by fishes, which so adjusts their specific gravity that they float with the least exertion. This balloon of the fishes is called the air bladder, and is a long, silvery tube readily found and recognized (Fig. 8, *vn*). This balloon is filled principally with nitrogen in fresh-water fishes, and mainly with oxygen in the salt-water forms, and the gas can be increased or diminished as occasion demands, the air bladder having an opening into the intestine in some fishes. The balloonlike air bladder is generally located between the backbone and the intestines; it varies in shape and size in the different varieties, and is entirely absent in some. The rays and sharks, which as a rule live on the bottom, have no air bladders.

This singular organ has another even more remarkable office, namely, that of a lung, enabling such fishes as the *Amia* and *Polypterus* to live out of water. In the fish last named, the air bladder opens into the throat or esophagus and is covered with blood vessels which take up oxygen directly. By this means the climbing perch (Fig. 37) migrates overland. The *Periophthalmus* (Fig. 40) wanders along the dry shore in search of food, breathing in the open air by the means of this wonderful organ, which in the water is an air bladder and out of it a lung or breathing organ.

The brain of fishes is very small and their intelligence is to a certain extent limited. The spinal cord extends from the tail, with many branches to fins and other organs, passing through the arches of the backbone to the skull, where it enlarges and finds protection as the brain. Nerves pass from it to the eye and various other organs.

The eye is an interesting organ, ranging from a large and singularly beautiful object in the fishes of the open sea to the minute and almost useless white dot in the blind fishes of caves. The ears are internal, yet the fishes hear distinctly, and it is supposed that the air bladder has still another office, that of aiding in increasing the sound waves—in brief, making the hearing of the fish more acute.

The chamber of the ear proper contains in some fishes little bodies called otoliths. Sometimes these are simple chalklike bodies, but those taken by me from the Californian grouper were found on each side of the brain and were really beautiful objects, opal-hued and highly polished, and very hard like stones. They were fringed or serrated, and each was a little over an inch in length. They are the "lucky stones" of fishermen, very few of whom know that they have any connection with the ear of the fish.

Among fishes the pursuit and capture of prey appears to be the chief object in life, and to enable them to accomplish it, nature has given them an arrow-shaped body, easily propelled through the water, powerful fins as locomotive organs, bright eyes to see their prey, and teeth or crushing jaws to seize and hold it. In the pursuit of food many fishes display the greatest voracity. I have

stood in water knee deep in Florida and seized "jacks," a large fish allied to the mackerel, and thrown them on

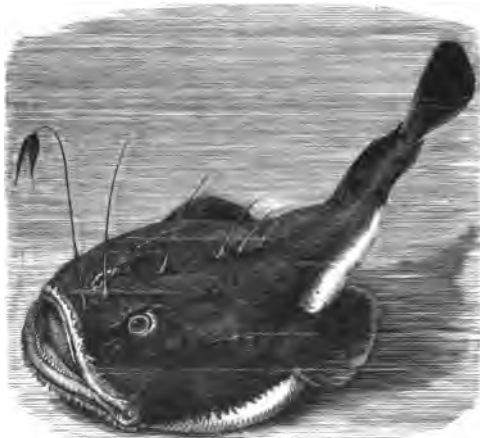


FIG. 9. — THE ANGLER (*Lophius*).

the beach where others had leaped in their excitement. They were feeding upon sardines and were oblivious of my presence. Some, as the mackerel, bluefish, sharks, and others, are wandering hunters. Others, as the great *Lophius* (Fig. 9), crouch

upon the bottom. The active tuna leaps into the air and often strikes its prey, a flying fish, in mid air. The

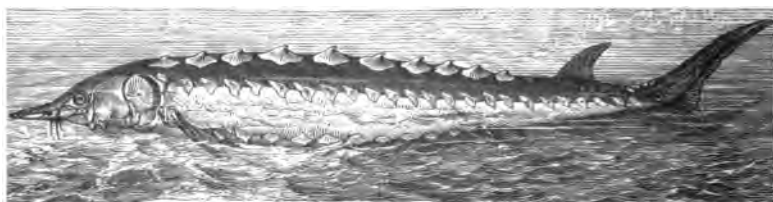


FIG. 10. — THE STURGEON.

sturgeons (Fig. 10) suck their food into their mouths, while the rays crush it.

Fishes do not chew or prepare their food. They tear off small portions or devour it whole, while the fishes

of prey swallow their victims alive. One of the most remarkable of fishes is the black swallower that devours fishes five times its own weight, its abdomen expanding like an enormous pouch, while the jaws are capable of great distention. Food so captured is swallowed with no preparation, and the amount which fishes will eat is almost beyond belief. It passes into the stomach and is there digested very rapidly and becomes the fuel of this wonderful living machine; the nutritive portions are absorbed and go to replenish blood, bone, and tissue.

Undoubtedly fishes suffer pain when injured, and it is manifestly cruel to subject them to useless agony. The sharks suffer the least, and a large one has been observed to feed when repeatedly cut through the head with a lance. Some of the large game fishes repeatedly take the hook. I once hooked a yellowtail twice within twenty minutes, the fish at the time bearing several hooks which it had taken within a week from various anglers. In this instance the jaws of the fish, though lacerated, probably gave it little inconvenience. On the other hand, fishes like the sardine, anchovy, and the beautiful ribbon fish are so sensitive that the slightest wound undoubtedly causes them pain and often kills them.

THE DISTRIBUTION OF FISHES

The movements of fishes, their singular changes from fresh to salt water, from deep to shallow, is an interesting and absorbing study. Certain fishes are adapted for life in fresh water and inhabit streams, rivers, and land-locked lakes; others have originally been salt-water forms

and have adopted the fresh-water life from choice, while many more change from salt to fresh water at certain seasons with marked regularity. The salmon (Fig. 11) lives in the sea a portion of the year, then runs hundreds of miles up fresh-water rivers to deposit its spawn. So with the shad, that is found along the shores of the South Atlantic States in winter, and in the rivers of the North at the approach of spring. Sharks are supposed to

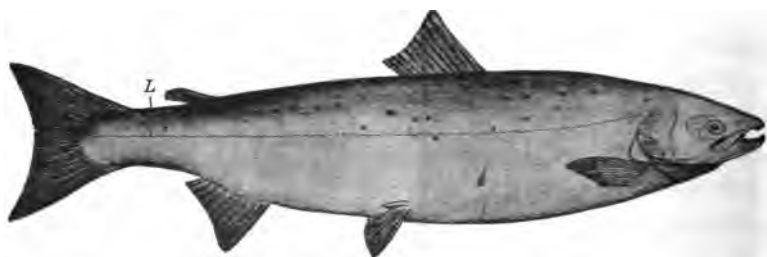


FIG. 11. — THE SALMON.

L, lateral line.

be strictly salt-water animals, yet one form is found in the lakes of the Fiji Islands and in Lake Nicaragua.

Fishes have found their way over the entire globe, wherever man has reached. Within the borders of the Arctic Circle there are fishes adapted to the intense cold, while the rivers of all tropical countries swarm with their finny populations. How fishes reach high altitudes and mountain pools is often a mystery; but trout and salmon have remarkable jumping power, and clear dams and falls that are seemingly impassable. A trout has been seen to pass up a spout of water that was issuing from a knot hole in a dam; and salmon make extraordinary jumps, so passing from pool to pool.

Inland and land-locked lakes are provided with fish in various ways. Fish spawn is carried in by birds, raised aloft by water and wind spouts and borne along for miles, then dropped to populate mysteriously a lake or pond that has been devoid of life. Fishes make their way up large rivers, follow the branches, and at periods of overflow, as in the Amazon, pass over miles of country, and reach depressions that are but lakes at other seasons. In this manner the world has been provided with a marvelous assortment of fishes, their geographical distribution being



FIG. 12. — BLIND CAVE FISH.

almost complete. They appear in the strangest places. In the Philippines, there are fishes which hop along the shore like frogs, even refusing to take to the water when followed, preferring the muddy flats. Some live in the deep sea, where the water is just above freezing and the pressure is enormous. Others affect an intermediate region, others again live in the mud of the shallows like the hogs; others again burrow in the sand, as the flounder; while many more are essentially surface forms, as the garfish and flying fish, never venturing below the surface and leaving the water when followed, rather than seek safety in the greater depths.

Certain fishes, having discovered the deep pools of caves, have remained in them and become adapted to the singular surroundings, and are now ghostly, almost eyeless creatures (Fig. 12). A very interesting example of this is the little fish *Lucifuga*, of the caves of Cuba. Its nearest relative is a salt-water fish found commonly in the Indian Ocean. The sightless cave fish was perhaps at one time a swimmer in the ocean, but was raised above its home when Cuba was thrust upward, and gradually changed, until to-day it is the solitary fish of its kind.

In the Southern States many of the subterranean rivers abound in fishes, and in Africa they have been taken from the deepest wells. There is hardly a region in the great world of the ocean not populated. There are the stay-at-homes in the tropics, wonderfully colored fishes which live about the coral banks from year to year, and the ramblers, as the bluefish, which move in vast schools from place to place. In this class are many of the best-known fishes. They school or congregate in vast numbers and move, a devastating army, preying upon smaller fry. The dogfish, a small shark, schools in the same way and often sweeps in from the deep sea in summer, a starving horde which carries all before it. I was fishing off the Maine coast, one August, when these voracious creatures appeared. One day cod, hake, and other fishes were plentiful off the banks, and the men made large hauls; the following morning, in the same spot, not a fish could be found. The water was filled with a throng of starving dogfishes which devoured everything. They even bit at the oars, and a sail which had been dragging overboard was lacerated by their teeth.

Many fishes prefer brackish water. Fishes have been found in water intensely salt, and some forms have been discovered in hot springs where the temperature of the water was 114° and 122° Fahrenheit.

THE LIGHT BEARERS OF THE DEEP SEA

While explorers are penetrating Darkest Africa, and attempting to reach the north and south poles, others are with equal interest trying to probe the caves and depressions of the deep sea,—the vast mysterious region that comprises nearly three fourths of the earth's surface. Its waves beat on every shore; its menace comes with every wind that blows, man crosses it, lives upon it; yet to-day it is the one region on the globe which really defies him; the one world which he is forced to acknowledge at the onset he can not enter. The very depth of the sea is a barrier unsurmountable. Two hundred feet is the limit of possible endurance of the skilled diver; yet beyond are six, possibly seven, miles of water, comprising the realm of the deep sea; a region as fascinating and alluring to the zoölogist as the pole has been to geographers. The very fact that the greater depths are unattainable has spurred men on to surmount the difficulties and to devise methods to wrest the secrets from the deep.

At the beginning of the past century the deep sea was comparatively unknown. I well remember when Agassiz the elder, with my father, dredged in Massachusetts Bay and considered the results in one hundred and fifty feet of water remarkable. That man could reach the greater depths was not believed possible, and in a general way it

may be said that all that has been learned of the ocean bed, and particularly of its inhabitants, has been discovered within the last third of a century. As has been seen, diving was impossible. The diving bell was one of the first inventions, and it was supposed that this would enable man to descend to a great distance; but the pressure of the water, which amounts to fifteen pounds to the square inch at the surface, rapidly increases as one descends, being equal to a ton weight upon every square inch of surface for about every mile of descent. It was soon found that it would be impossible to invent armor to withstand this pressure, and the inventive genius of man was now directed to dredges with which to trap the denizens of the ocean.

America, England, Germany, France, Italy, and Sweden were among the first to send out ships to explore the deep sea. The work of the *Albatross* is well known. The *Challenger*, of England, made the tour of the world to map the deep sea, and magnificent volumes have been issued—the simple story of this voyage alone, the combined results of the investigations of the naturalists of the world to whom the specimens were consigned. Italy sent out several ships, France the *Traveler*, and there have been many more. Space will not permit a description of the methods of work, and it is sufficient to say that the dredge is the instrument used—a machine like a huge bag, twenty feet or more in width, and as many in depth; the mouth held out by a boom which rests upon the bottom. This drag net, or dredge, is lowered overboard by a small cable wire, and to it are attached various instruments to test the depth, density, and temperature of the ocean. To

lower so cumbersome an instrument is in itself a problem, and often to obtain the greatest depth several hours are required, and then it is often difficult to determine whether bottom is reached.

Assuming this is accomplished, what chance has the dredge to perform its work? Imagine the possible inhabitants of Mars to have solved the problem of crossing space between them and the earth. They reach with their balloon within seven miles of the surface of the earth and plainly see cities and other large objects; but they find that the atmosphere is too dense to enable them to descend. Yet their mission is to take away some of the inhabitants of the earth. They lower from their balloon a dredge, attached to a wire eight or ten miles long, which they slowly drag over the fields of the earth several hours before it is hoisted up. It is very evident that the rabbits, birds, and all the active animals will easily evade this clumsy trap, and all that are caught are earthworms, plants, a turtle perhaps, and an assortment of animals which could not move out of the track of the dredge. In a word, dredging is very discouraging work, and well illustrates the chances which the modern naturalist has of making an adequate study of the life of the deep sea. The dredge is dragged along the bottom of this unknown land beneath the sea, up the sides of hills, over plains, plowing through the mud, naturally capturing only those forms which are concealed in the ooze and are too sluggish to escape; yet by these crude appliances all that is known of the deep sea has come to us, the specimens are few in numbers, comparatively speaking, but so remarkable as to make this department of zoölogy one

of the most interesting and important at the present day.

Before referring to the results of these investigations a glance may be taken at the ocean bed to note how carefully it has been mapped by the various expeditions. The ocean is before us day after day, hence its beauty or its meaning is not always appreciated; but the murmur in the sea shell, the booming of the waves, the wild crash of the surf on hidden rocks, are the voices of the deep sea, full of poetry, full of mystery; telling of this world of the abysmal sea.

It is a marvelous, incomprehensible thing, this ocean. It is nearly three miles deep on an average; so very deep in places that it is ten miles from the top of the highest mountain to the bottom of the deepest cave or abyss that ocean bears. I once crawled into the dry bed of a subterranean river, three miles beneath the outside world; when in the last tunnel, which was fifteen feet across and two hundred feet high, the guide blew out the light that absolute darkness might be realized. The deep sea, six miles from the surface, is, in places if possible, darker than this. At a depth of three or four hundred fathoms plant life ceases, which means that sunlight is exhausted. I once attempted to descend the face of a perpendicular coral cliff, on the Florida reef, to determine, if possible, how deep the coral grew. Holding a heavy weight in my hand, I allowed it to drag me down rapidly. I could at the time remain under water over a minute, and estimated that I could descend thirty feet in safety. At the word the men released the weight and I was dragged downward, but parted company with the weight before I had reached

thirty feet. I well recall the disagreeable sensation of the marvelously rapid loss of sunlight, and the sudden cold at even twenty feet.

The deep sea is a realm of silence so profound that the mind can not realize it. It is also intensely cold, varying from one degree below freezing to several degrees above. That life, and prolific life, can exist in such a region does not seem possible; yet there is every reason to believe that every mile, every acre, of this weird region is inhabited. Perhaps the most remarkable feature of the ocean is its depth; only about seven tenths of its total area is under six hundred feet deep; of the rest sixty-two per cent is over two and a half miles; and there are nearly fifty places known where the water is more than three miles deep, and many where it is four and five. It has remained for an American to find an abyss, off the coast of Guam, 5260 fathoms deep; and from this dark recess, ten miles below the summit of Mount Everest, life has been taken.

Up to within a few years it was supposed that when the deep sea was explored early forms of life would be found; but the consensus of opinion to-day is, that the animals are those which have been driven by enemies, or by the force of circumstances, into the depths and there adapted to the strange conditions, and that they are more or less degenerate forms. The abyssal regions of the ocean, the regions of greatest depth, cover seven million square miles of the ocean bed, and all are named, as are our deserts on land. Thus the Sigsbee Deep indicates a vast depression south of Nova Scotia; the Aldrich Deep one east of New Zealand; the Ross Deep the vast

Antarctic depression. There is no law relating to their situation; they occur everywhere. In descending into the ocean the area within six hundred miles of land is, as a rule, more or less affected by it; gravels washed from rivers being commonly dredged, as the bed descends or drops away. Beyond this depth the dredge finds clay and mud—red, blue, and green—made up of minute shells, the remains of countless millions of animals, the famous Radiolarian ooze, the ooze of the diatom, the quicksand of the deep sea. Beyond this, on the slopes of the deeps, from two to five miles, the dredge shows that the shells have been dissolved, and the floor of the ocean—certainly one half of the entire expanse—is covered with a soft red clay, composed of the wreckage of meteors, pumice from submarine volcanoes and cosmic dust. Vertically the ocean is divided by Agassiz into three zones: first, that of two hundred fathoms—theoretically the belt of sunlight; second, the azoic—a belt of darkness; third, the deep sea, into which in imagination the reader may descend.

He may well believe that the inhabitants of so peculiar a region must be peculiar in themselves, and it may be said that nature, in adapting these animals to their environment, has produced forms which defy adequate description, so weird and grotesque are they. It would be impossible in the limited space to mention more than a few of the types, but there is one feature which amazes the scientific investigator and challenges the attention of the layman; that is, the illumination of the deep and sunless sea. Almost all of its animals are light givers, living lamps, flashlights of the deep; fishes provided with

a wonderful system of illumination. The reader may well ask, how can delicate fishes withstand the enormous pressure? Nature has changed the deep-sea fishes into seeming living sponges; in a word, the water permeates their entire system. The bones are so loosely connected that it is almost impossible to lift one of these fishes without its dropping to pieces. The bones are cavernous and fissured, filled with holes and crevices; a pin can be thrust into them anywhere, and the slightest movement will bend them. The muscles are thin and weak, and the fish is apparently a perfect sponge, offering little or no resistance to the water bearing upon it from all sides.

The imaginary observer may well be fascinated by the weird forms of fishes which swim by, or lie partly buried in the ooze. Nearly all are light givers. Some are ablaze over their entire surface; others have eyes of seeming fire; in others, again, the light flashes from barbels, decoys, signals, and reflectors, which, in tints of green, orange, and yellow, cover the bottom of the deep sea. Beyond, a cloud of light takes shape in which hover multitudes of luminous fishes, many of which possess a system of illumination of two distinct kinds and of a marvelous nature. A long eel-like shark swims by, followed by another, equally strange. They are, particularly the latter, ablaze with light from head to tail. Its existence is not mere theory, as several specimens have been brought to the surface, notably by Agassiz and Bennett. The latter says: "The entire anterior surfaces of the body emitted a vivid and greenish phosphorescent gleam, imparting to the creature by its own light a truly ghastly and terrific appearance."

Nearly all of the large fishes possess a peculiar mucilaginous system supposed to be the seat of this light. The wildest flight of the imagination fails to conjure up more remarkable creations than the grotesque figures which glide by, project from the ooze, or, startled by the intruder, dart into it. Many of these fishes, which are not luminous over their entire bodies, have a system of lights, lures, lanterns, and flashlights of various colors and shapes, all taking the form of special organs. Sometimes they are merely lights or signals by which the fish may be recognized by their fellows; and again, as in the case of the fish *Ipnops*, the flashlights fairly cover the head, forming two reflectors, which are also eyes, or their equivalent. With such an array of lights, enabling the fish not only to envelop its prey in its light, but to throw a halo about it, and also see it, what imagination can picture the scene when two of these living reflectors are chasing and surrounding a victim? Pursued by enemies so equipped, escape would seem impossible. The witness of these marvels, were he a careful observer, would note that the lures are of different colors; that in some they imitate some small animal wriggling and coiling, and emit a flashing tremulous light, and attached to perfect fishing rods on the back of some veritable monster concealed in the ooze.

Out of the gloom comes a strange light giver — the culmination of nature's efforts, apparently, in the direction of the flashlights, as this fish has four lights which undoubtedly assist it to capture its prey. Two of these lights are above, and two below, the upper emitting a yellow or orange-colored light, while the lower, just over the mouth,

glow with green tints—a strange disposition enabling *Malacosteus* not only to throw searchlights around its victims, but to lure them within reach of its terrible fang-like teeth by the display of various colored gleams.

The *Stomias*, with its ferocious, dragonlike head and teeth, has rows of flashlights along its lower surface, which mark it in golden lines against the dark background. The hideous, almost square-shaped *Sternoptyx* floats by, with twenty or more flashlights along its lower surface; three higher up and three higher still, like the open port-holes of a ship, from which fitful gleams are streaming. *Argyropelecus* (Fig. 15) is ablaze with lights, which cover its lower surface, and the same is true of a host of others. Long, eel-like fishes, with enormous mouths, swim by. The mouth opens downward, and is filled with recurved fangs, and from the lower jaw depend several tangles or lures, which being luminous possibly attract victims from below, while in double rows all along the slender body are seeming countless pearls, each a reflector of the mysterious light.

The array of fishes with lights placed in different positions is amazing. One has them dotted over its sides; another has three blazing on its cheek, three long ones on the under jaw, while in the blunt-headed *Diaphus* the three lower head lights are of large size and throw the gleams downward.

If these are remarkable, what can be said of the school now passing by (Fig. 13)! One strange fish has lights along its sides, and the entire front of the head seems to be a flashlight, or reflector, which throws the blaze of light directly ahead, after the fashion of a locomotive.



FIG. 13. — LUMINOUS FISHES OF THE DEEP SEA.

1, *Chauliiodus*, one foot long; 2, 9, 10, 11, *Harpodon*, or Bombay duck, six inches; 3, *Plagiiodus*, six feet; 4, *Chiasmoides*, one foot, with *Scopelus* in its stomach; 6, *Beryx*, one foot and a half; 8, *Scopelus*, one foot.

Following it, in the glare of its own light, comes another fish, with its enormous mouth filled with fangs, while a group of mud lovers slink away from another terrible creature as it swims by, dangling a bulb of light from its lower jaw. A group of fishes which can not fail to attract attention have mouths so enormous that they can swallow a victim half as large as themselves.

Every step taken in the ooze, which here and there emits a greenish spectral light, startles fishes which live in or about it. One seems all mouth, literally a living sack (Fig. 13, 4) which lies in the mud engulfing its prey. Another illustrates the perfection of mimetic mechanical appliances; its enormous mouth opens upward. At the surface of the ooze and directly over the fish, by the aid of a long fishing rod, dangles a bulb, or bait, that is phosphorescent and made to simulate a living worm, or some small crustacean. But the most extraordinary sight, perhaps, to be witnessed here, is that of the electric bulb fish. It is a shapeless horror. Its mouth, which is a third of its entire extent, is armed with teeth of extraordinary length. From the tip of the upper jaw rises a perfect electric bulb so far as appearances go. This is a lure perfect for its work, emitting a bright light, and standing above the mud in which the fish is totally concealed. Over the bottom these green lights are scattered, far and near, exemplifying the most extravagant efforts of nature in the direction of illuminated fishes. Another remarkable and grotesque fish has a mouth which opens back a third of its length and is armed with a luminous bait. Its side or pectoral fins are placed far back, near the tail, while two fins, longer than the entire body, rise from above and below.

As if this were not enough to mark this fish unique, it is supplied with wormlike, light-emitting barbels of flesh, which rise from its head, back, and sides — effective lures, if such is the intention of nature.

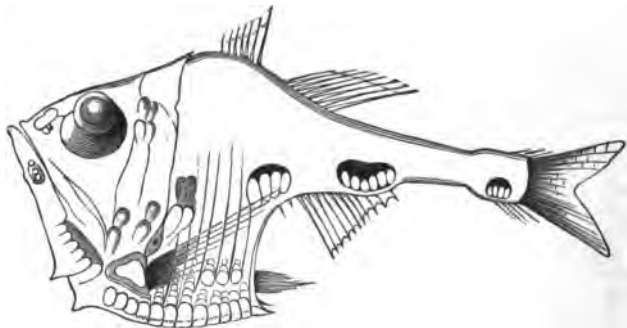


FIG. 14. — A LUMINOUS FISH.

Many of these fishes are covered with a peculiar mucus, and nearly all have simple colors — black or silvery. Many are dotted along the lower surface, upon their sides, and upon the head near the eyes with singular spots like mother-of-pearl (Fig. 14). Some, especially those on the head, are elliptical in shape; others are globular (Fig. 15), and all are supposed by some naturalists to be luminous organs, while others are believed to be organs of vision to aid the fish in seeing in these dark depths of the sea.

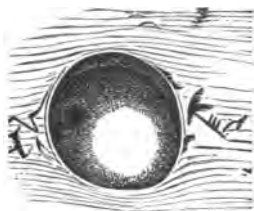


FIG. 15. — LIGHT-EMITTING ORGAN OF A FISH.

A remarkable small-eyed, deep-sea fish is the *Bathypophis*, which has no common name and is rarely seen. Its home is a mile or more beneath the surface. Its

eyes are so small that they can scarcely be seen. It is like a blind man groping in the dark; its canes two slender feelers almost as long as the fish, rays of the side or pectoral fins having at their tips delicate sense organs or feelers. When the fish swims, they are trailed



FIG. 16. — GROUP OF LIGHT GIVERS.

behind, but they can be thrown forward to investigate the ground as it advances. The ventral fins also bear two long feelers.

These singular "fingers" are found in various places; thus, *Eustomias*, a hideous black creature, has a very long finger pendent from its lower jaw, which it uses in

its search for food eight or nine thousand feet from the surface. Stomias, another form, with dragonlike head and fierce teeth, has a short-branched, fingerlike tentacle hanging from its lower jaw, and rows of gleaming lights along its entire lower surface. From the depth of

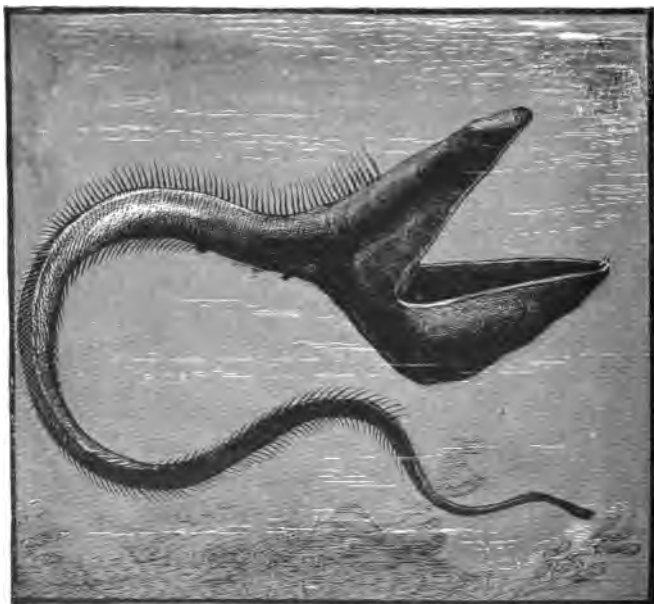


FIG. 17. — THE PELICAN FISH.

two miles the naturalists of the *Challenger* took the fish Bythites, and from three miles still another form, while the *Albatross* has secured equally interesting fishes seventeen thousand feet below the surface of the sea.

The lights with which these fishes are provided to enable them to secure their prey in a region of the deepest

darkness, are among the most wonderful provisions of nature, showing that everywhere animal life is adapted to its peculiar surroundings. The large black velvet-hued fish *Echiostoma* has two lights just below its eyes. The little fish *Sternoptyx* (Fig. 16), when it first came up in the dredge, gleamed like a coal of fire, the light being distinctly seen by the German naturalist, Dr. Suhm. I have before me several remarkable little light-giving fishes which I found at the Island of Santa Catalina, California, where they were washed up by a storm. Light has been seen to gleam from the large phosphorescent spot near

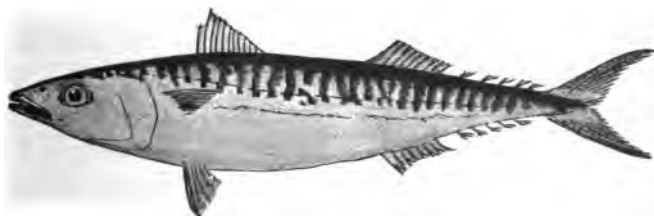


FIG. 18. — THE MACKEREL.

the eye of this fish, which resembles Figure 15. This spot is supposed by some to possess the properties of an eye and a light-giving organ. The light is believed to be produced at the bottom of the back chamber of the organ and distributed in many directions; in other words, after the fashion of the convex glass of a bull's-eye lantern.

Besides the luminous organs on the head of *Sternoptyx*, whose mouth is so large that it stretches from "ear to ear," it has thirty-three "light spots" along the lower surface, facing downward: six in front of the ventral fins, six more between the ventrals and the anal, and twenty-one between the front of the anal fin and the base of the

tail, — enough, if all are luminous, to mark the little creature as a blaze of light against the water.

Many of the deep-sea forms have enormous mouths, and literally haul themselves over their prey as a glove is drawn on the hand. Such an one is the black swallower, *Chiasmodon* (Fig. 13) that has been found with a fish in its stomach several times larger than the swallower itself, due to the remarkable expansion of the saclike stomach.

The large-mouthed forms find their most remarkable example in the pelican fish (Fig. 17), that is almost literally all mouth. It was taken from the bottom of the sea in seven thousand feet of water, and undoubtedly feeds by swimming along and blindly engulfing all the animals in its path. None of these fishes have common names. The fish *Chauliodon* (Fig. 13) is a fierce and ravenous creature. *Bathypophis* resembles a salmon, but has wonderful feelers, which it throws out ahead — sense organs of some kind. The strange *Dibranchius* simulates a moss-covered rock, as it crouches in the ooze. Over its upper lip is a small light or lure, which attracts prey to the monster. Other strange fishes are *Cyclothone*, with mouth filled with fangs, *Astronesthes*, with a bulb like that of an electric light dangling from its lower jaw; but more wonderful than all is *Linophryne*, a shapeless horror, fairly cut in two for a third of its length by its mouth, which is armed with fanglike teeth of extraordinary proportions. From the lip of the upper jaw rises a bulb of light — so far as appearances go, an electric bulb. This fish undoubtedly hides in the ooze or mud, with the bulb of light gleaming above it, attracting prey, which is suddenly pounced upon.

The most vivid imagination fails to depict creatures which equal the simplest animals of this weird region, ranging as they do from the splendid *Malacosteus* with its many colored lights to the strange two-horned angler, with enormous head, small eyes, and feetlike fins, which throws forward a jointed rod as long as its body, on the end of which is a blazing lure. Small fry approach this bait, which is gradually lifted, until they are over the cavernous mouth, which suddenly opens and engulfs them.

The reader will wonder how these fishes, four or five miles down, obtain air. The fishes at the surface are provided with oxygen by storms and wind which beat the water into foam, so aërating it or forcing globules of air downward. But such an explanation will not apply to the deep sea; the surface storm is not felt even a thousand feet from the surface. It is believed that a very sluggish current creeps along the bottom of the ocean from the poles to the equator, there rising to return again at the surface, and it is supposed that this silent river conveys air in sufficient quantity to sustain life in the deep sea, where all the animals have become adapted to the strange conditions and are able to exist upon the very limited supply of oxygen.

Some of the deep-sea fishes are very snakelike; others are eel-like, as certain sharks, and it is supposed that in the deep sea exist certain huge forms which occasionally ascend to the surface, giving rise to the theories of the sea serpent.

YOUNG FISHES

It is a popular belief that fishes roam about over the sea without regard to time or place and have no home life, no love of locality, as the terms are understood among birds and other animals. This is not strictly true. There is every reason to suppose that even the roaming fishes descend to favored regions in the deep sea year after year, and have localities of their choice.

Before glancing at individual instances of home makers among fishes it may be interesting to observe the young and their struggle for life. The fishes increase in several ways. The majority deposit eggs, while in a few instances, as *Ditrema*, one of the Californian surf fishes, the young are born alive. Many of the fishes have a sense of parental responsibility. Others devour their own eggs or young; such are the herrings, sardines, barracuda, bluefish, and mackerel (Fig. 18), which in most cases undoubtedly deposit their eggs on or near the surface, to become the prey of many animals. As soon as the young fishes appear, sea birds observe them, and from then until they attain the adult stage they are followed by scores of predatory animals, their lives being preserved only by a constant struggle to evade some watchful enemy. It is evident, then, that very few fishes comparatively, escape or live to reach the adult size, and were it not that they deposit vast numbers of eggs they would soon become extinct. Thus, the common eel deposits 8,000,000 eggs. It is estimated that each female codfish deposits 9,300,000 eggs, which rise to

the surface and afford food for many fishes. Others famous for their vast numbers are as follows:—

FISH	WEIGHT OF SPAWN IN GRAMS	ESTIMATED NUMBER OF EGGS
Haddock	—	1,839,581
Carp	2571	500,000
Conger Eel	8 lbs.	3,300,000
Flounder	2200	1,357,400
Herring	480	36,900
Mackerel	1223	546,681
Perch	765	28,323
Pike	5100	49,304
Roach	361	81,586
Smelt	149	38,278
Sole	542	100,362
Turbot	5 lb. 9 oz.	14,311,200
Cod	—	9,300,000
Lumpfish	—	400,000
Halibut	—	3,500,000
Sturgeon	—	7,635,200

Fish spawn as a rule resembles an enormous mass of minute spheres, ranging from those almost invisible in the water, to others as large as the head of a pin. Some are deposited singly, others in bunches, some fastened by strings of mucus to seaweed. Others are buried in the sand or among the rocks, and many finny egg layers, to be referred to later, are remarkable nest builders, ranking among some of the birds in this respect. Among the interesting egg layers are certain sharks and rays. One, taken from the waters of Santa Catalina Island, is the Port Jackson shark, the egg of which is almost as large

as the hand of a child, inclosed in a thick, black, leathery case coiled in a perfect spiral and so remarkable in its resemblance to the seaweed or kelp in which it is laid by the fish, that it is perfectly protected. Some of the dog-fishes lay an egg that in shape is like a barrow with four handles which wind about the weed and swing in the current,—perfect mimics of the surrounding weed (Fig. 19). This is true of the rays; and the eggs of the singular fish *Chimæra* are deposited in thick, leathery cases. The egg case of the fish *Callorhynchus* is mar-

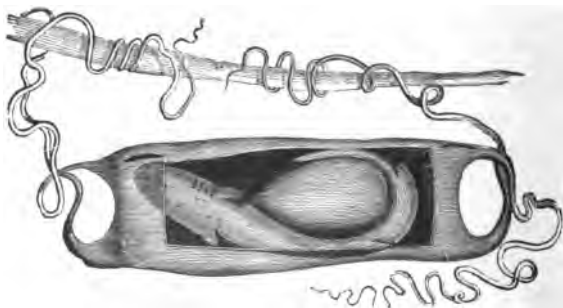


FIG. 19. — BARROW-LIKE EGG OF A SHARK.

velous in its mimicry, resembling, almost perfectly, in color, shape, and movement, the leaf of the fucus, to which it is attached.

Equally interesting is the egg of the hagfish, *Myxine*, that is found enveloped in a bundle of mucus. The eggs are oval, fifteen millimeters long and eight millimeters broad, enveloped in a horny case. From the ends extend masses of threads, each of which ends in a triple hook that serves as an anchor to hold the egg to seaweed or other objects. These eggs are rarely noticed by predatory animals. They are deserted by the parents, the young

breaking their way out when fully developed, and being exposed to all the dangers to which young fishes are subjected.

Among the fishes which care for their eggs none adopt a more remarkable method than the *Aspredo*, a South American catfish which when depositing the eggs settles down upon them like a hen upon her young. But here the resemblance ends; as the *Aspredo* rises, could the reader follow, he would see that the eggs were all clinging to her, being carried about in this way until they are hatched. This fish with one other, *Solenostoma*, is the only well-authenticated instance known where the mother fish cares for the young or displays any solicitude for them, the responsibilities all devolving upon the male parent. The *Chromis*, found in Lake Tiberias, shows its solicitude for the eggs in a singular way. As soon as they are deposited, the male fish seizes them in his capacious mouth and carries them carefully, not only until they are hatched, but so long that finally the growing youngsters force his large mouth and gills open, giving him a ludicrous appearance. Professor Agassiz found a little fish in South America that protected its eggs and young in this way, and it is be-



FIG. 20. — THE SEA HORSE.

lieved that there are several others. The little sea horses (Fig. 20) and their allies have a method of protecting their eggs which recalls the kangaroo, although it should be

remembered that it is the male, not the female, that has the pouch into which the eggs are received. In others of this group there is no pouch, the eggs being merely attached to the abdomen. In the *Solenostoma* from the Indian Ocean, a pouch is formed in the female by the folding of the ventral fins, and in this the eggs are held in place by long fleshy filaments. This is the second instance known to me where the mother displays any solicitude for her young.

THE NEST-BUILDING FISHES

A few fishes resemble the birds in their skill in building nests for their young. The salmon and trout may be compared to the gulls, as the nest which they are supposed to form in the sand is merely a depression where the eggs are deposited. Certain birds, like the brush turkey, erect large mounds of earth and leaves in which their eggs are deposited. This method finds a counterpart in the *Semotilus*, a fish common in many Northern streams. Once in poling a boat along in one of the shallow bays among the Thousand Islands, I ran aground on what appeared to be a miniature mountain of pebbles, which ranged in size from a small marble to that of a walnut weighing two ounces. There were thousands of stones, and the heap must have weighed nearly a ton. Each stone had been brought to the spot in the mouth of a patient *Semotilus*, and the heap represented the accumulation of many seasons. It was the nest of the fish, the eggs deposited upon it sinking into the crevices,

which would afford protection to the young. Several of these nests were scattered about in the little bays near Westminster Park, and were not supposed to be nests of fishes by the dwellers thereabouts.



FIG. 21. — STICKLEBACK AND NEST.

The lamprey eel builds a similar structure for the protection of its eggs. One nest observed in the Saco River was sixteen feet in length by four in height, and was formed of stones ranging in size from that of a nut to that of half a brick. These building materials the lampreys brought down the stream in their suckerlike mouths

in a very ingenious fashion. In the case of a heavy stone they would attach themselves, sometimes two eels to a stone, and by a convulsive movement wriggle themselves upward from the bottom; then they would allow the current to carry them down to the nest, where the stone would be dropped. At this nest many eels worked until it assumed almost the proportions of a dam and constituted a rocky fortress, protecting thousands of young lampreys.

One of the best known of the nest builders is the stickleback, nearly all of the family being nest builders (Fig. 21) and some displaying great ingenuity in the construction of the home. In those kept by the author the males performed all the work. These fishes were at this period tinted with pink, especially about the head. They would collect small bits of grass and weed, reminding one of birds gathering material for their nests. These objects were deposited in some corner of the aquarium until a little mound that had been molded into a definite shape was the result. The fish had a bobbin-shaped body and would dash into the nest, sometimes passing completely through it, as shown in the illustration drawn from some pets of the author; again rubbing itself against it, then darting off, savagely attacking some enemy that had the temerity to approach. The movements of the fish about the nest will not be understood unless they are carefully watched. It is binding its building material together by a magic and glasslike cord which it takes from a pore on the lower side of its body. If observed closely, it can be seen rubbing itself against the weed, the peculiar secretion sticking wherever it touches, and hardening into a cord or thread, which binds the nest together as com-

pletely as if it had been wound about with strings. When the nest is finished, the eggs are placed in or attached to it and there find protection. There the little fishes live until they are large enough to stray away. The mother fish does not exhibit the slightest solicitude for the eggs or young, and deserts the nest as soon as the eggs are deposited. But the

male takes her place and stands guard, attacking all comers, and even darting at a finger when it is pointed at him. When the little ones appear, his labors are greatly increased, and he is repeatedly observed to draw wandering fishes into his mouth and expel them violently into the nest.

Finally, however, they grow too large to be herded, they gradually separate, and the nest is broken up.

One of the most attractive nests that I have seen in course of construction was that of the paradise fish (Fig. 22), a beautiful creature found in Chinese and East Indian lakes and streams. This fish has a rich green tint, with long, plumelike fins which reach out behind, giving it a particularly graceful appearance. The nest is of air bubbles, and is formed very much after the soap-bubble



FIG. 22. — PARADISE FISH AND NEST.

fashion. The male fish rises to the surface, and with a distinct clicking sound fills its diminutive mouth with air, which it holds for a few seconds and then releases, the air escaping as a silvery bubble, which rises to the surface and remains there. The air bubble has in some manner been surrounded by a delicate envelope, so that it is really a miniature balloon. To this the fish soon adds another and another, until a raft of bubbles as large as a dime is observed floating on the surface. This is added to until there are two rows, and the entire mass is a double-decked raft of air bubbles the size of a watch. In this floating nest the eggs are deposited, and there the young paradise fishes find their first food.

In Californian waters are found the egg mass of the blue perch fastened to the kelp by strings of some secretion, there evidently being an attempt to fasten them together in a rude nest. The most perfect nest of this kind is that of the little fish *Antennarius*, common in the Gulf weed. Like the stickleback it has a pore from which it takes a glutinous secretion which turns white as soon as it touches the water, and soon becomes very strong. This



FIG. 23.—TOADFISH.

secretion is wound around masses of floating weed until a compact nest as large as a Dutch cheese is the result. In this the eggs are placed,

resembling little rubies dotting the branches. Here they remain until hatched, the young fishes feeding upon the delicate growths which abound, until they are large

enough to care for themselves. A number of South American fishes are nest builders, notably the Acara. The East Indian Gourami, which came originally from Cochin China, forms a nest from mud and grass, building the structure in a week.

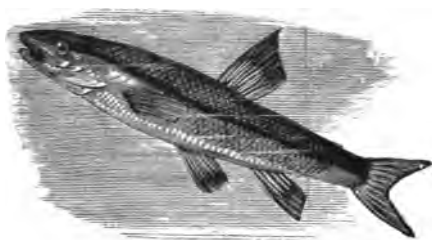


FIG. 24. — THE DACE.

In this the eggs, numbering about one thousand, are placed. The *Ophiocephalus*, an allied fish, has a similar habit; and many similar instances could be cited to show that the fishes have more intelligence than is generally accorded them and possess no little building or constructive ability. The toadfish (Fig. 23) forms a simple nest for its young, and the common black-nosed dace (Fig. 24) builds a mound-like nest.

THE STRUGGLE FOR LIFE

Having observed the habits of the parent fishes in their egg laying and nest building, it may be interesting to go a step farther and follow the young fishes in the struggle for existence which marks every stage in their lives. At the hatching time—March, April, May, or June—the waters often seem filled with small fry, and birds and larger fishes snap them up by thousands. When the young first appear, they are almost invisible and are then food for the small fishes. Their numbers are soon

decimated, for the school is followed day and night by a marauding horde. Often these enemies are the fathers, mothers, brothers, and sisters of the young fishes, as, in a family of millions, ties of relationship are lost sight of, and the family of a preceding season greedily devours those of the following, and even their own progeny.

The great majority of fishes, as the cod, flounders, hake, young shark, herring, bluefish, and their allies, are at once thrown upon their own resources and but a very small percentage escape. The Acara, previously referred to, carries its young for some time in its mouth. The lumpfish, which has a singular sucker on its ventral surface by which it can anchor itself, is followed about by its progeny as chickens or ducks follow their parent, though in this case it is the male that stands by the family. He it is that builds a nest for them, and when they are hatched he must face a most remarkable proposition. The number of eggs is estimated at from two hundred thousand to four hundred thousand, and the few survivors very soon fasten themselves to the father fish and are carried about by him.

The lumpfish or sucker is called the hen and chickens, as it is often seen swimming slowly along, followed by its numerous young. The young of the great armored garfish have a peculiar method of protection. The eggs are large and easily attach themselves to any rock or stick. The young, when they first appear, have little or no resemblance to the parent. They have large mouths over which is a row of suckers by which the little garfishes attach themselves to the rocks. Later these arrangements disappear.

The fish in the Jordan known as Halch and several of its allies have a peculiar habit of carrying their young in their mouths. If we could watch some fishes when they first appear, it would be seen that they bear little or no resemblance to the parent. So marked is this in some instances that the young fishes have been described as en-

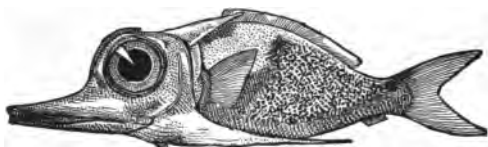


FIG. 25. — YOUNG SWORDFISH.

tirely different individuals. The swordfish, regarding whose breeding habits very little is known, is supposed to deposit its eggs on the high seas. When the young appear, they are very strange little creatures, with enormous eyes, two beaks, equal in length (Fig. 25), and many other points in which they differ from the adult. Many young fishes have strange ornamental fins which disappear when they attain their full growth. Such is the Fierasfer, which has a dorsal fin that mimics a vine. Another has what resembles two plumes over the eyes.

But the most marvelous change is seen in the little flat-fishes or flounders. When very young they swim upright, have an eye on each side, and to all intents and purposes resemble other fishes, as the archer fish. But as they grow older they assume the wide flounder shape, and soon seek the bottom of sandy flats and develop a tendency to lie down. This brings one side against the bottom and renders the eye useless. The latter seems to resent this, as it begins to move over to the upper side (Fig. 26), the mouth gradually twisting itself into a shape to conform to

the new position. In time the eye completes its travels, and we find it on the upper side, having passed completely around the upper or dorsal edge of the fish.

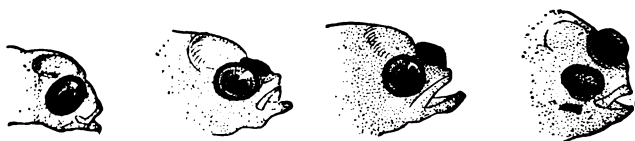


FIG. 26. — SHOWING THE JOURNEY OF THE EYE OF A FLOUNDER.

After Agassiz.

When this is accomplished, the dorsal or top fin grows forward beyond the level of the eyes.

An exception to this is found in the flounder, *Plagusia*, in which the dorsal fin grows to the snout, while the fish has an eye upon each side. The fin appears to form a

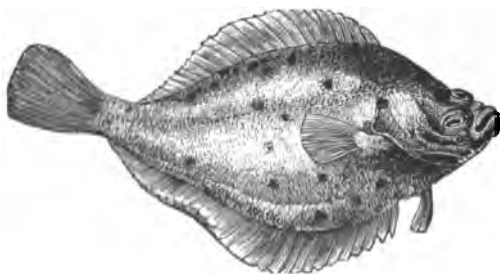


FIG. 27. — A FLOUNDER.

barrier to this wonderful traveling eye, which seems almost to have an intelligence of its own. But it is not to be foiled, and instead of attempting to

pass the fence-like dorsal fin or frill, it sinks into the soft tissue and comes out upon the opposite side. Finally we see the flounder hugging the sand, with its two eyes on top moving about independently, while the mouth is screwed and twisted out of shape to conform to the new condition of affairs.

A Japanese naturalist, Mr. Nishikawa, has discovered another method, intermediate between the two, where there is a distinct hole formed by the dorsal fin and the head, through which the wandering eye passes in its journey to the upper side.

Many young fishes are armed with curious spines which disappear later on. Young fishes soon assume the habits of their parents. The sharks separate in all directions; the sardines and herring (Fig. 28) cling together from the very first and form schools, which are followed by predatory



FIG. 28.—A HERRING.

fishes without cessation. I have seen a school of young sardines, composed of tens of thousands, so intimidated that they formed a seemingly solid ball about ten feet across. Around this swam a seal, occasionally dashing into it and seizing a mouthful, then darting away to prevent the escape of the school. This seal succeeded in keeping the school in almost the same position for over half an hour. Soon other enemies gathered; loons, cormorants, and other diving birds were swimming beneath the water, darting into the midst of the frightened fishes and devouring them by the score. On the outskirts hungry yellowtails hovered about and picked up the stragglers, and the complete destruction of the school seemed about to be accomplished.

The young flying fishes, which I have observed darting out of the water like grasshoppers, form an illustration of fishes which do not school closely. A thousand might spread themselves over many acres, while the sar-

dines and herrings generally swim in close file, massed in great silver bodies that to the animals below them must present the appearance of a silver sky. It is very evident that did not nature prevent it, almost complete extermination would be the result of the depredations of the large fishes. But nature is a perfect care taker. The little flounder drops to the bottom and is enabled to disguise itself by imitating the object upon which it rests. When



FIG. 29. — A SEA HORSE THAT RESEMBLES SEAWEED.

on white sand, it is very light; when on a brown bottom, its flat, broad back is brown, and almost perfectly protected from observation. This power of concealment is called protective resemblance or mimicry, and is possessed by many fishes.

The young sculpin is a marvelous mimic, and can hardly be distinguished from the rocks among which it hides. The little Antennarius, the nest builder of the Sargasso Sea, mimics its surroundings in shape and

color; and that the protection is not accidental can be shown by changing the fishes from a light to a dark bottom and back again. One of the sea horses mimics seaweed (Fig. 29). The changes are produced by lights and colors which create certain impressions that are carried from the eye to the various pigment cells, making some contract, some expand, producing the changes. That the eye is the medium has been shown by severing the optic nerve on one side; the result would be a fish striped on one side and light brown on the other. Nearly all the bottom fishes are thus protected.

Young fishes often find safety in strange places. Many of the large jelly fishes, especially in the tropics, afford shelter to minute fishes, usually allied to the mackerels, which dart about beneath the crystal-like umbrellas and mimic the tentacles or streamers of their protectors so perfectly that it is almost impossible to distinguish them. In a large number of jelly fishes I have examined on the Florida reef there was rarely one that did not have attendants in the guise of young fishes. Even the beautiful yet deadly Portuguese man-of-war had several attendants, marvelous in their mimicry, as each fish (*Nomeus*) was the exact tint of the blue tentacles of the fairylike animal.

The rate at which fishes grow and the age which they attain, are interesting subjects of study. Some grow very rapidly, especially the herrings, which appear to be full grown in five, eight, or nine months; others require several years to attain full growth. The temperature of the water and the food supply are important factors which must be considered. The rapid growers, such as the herrings, which soon attain a certain size and then

stop growing, are believed to be short lived. Those which slowly and steadily grow, as the pike and carp,

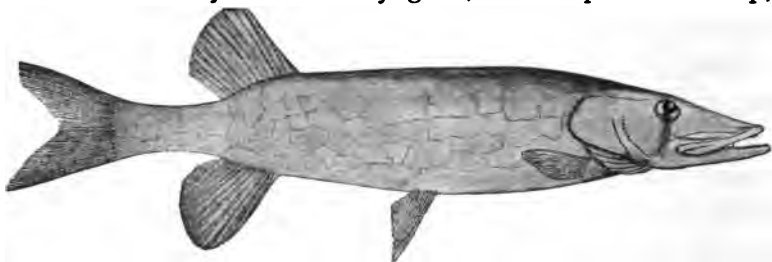


FIG. 30. — THE PICKEREL.

undoubtedly attain a ripe old age, passing the century mark. Sir John Lubbock gives the age of carp as one hundred and fifty years.

THE SHARKS AND RAYS

The sharks and rays differ very materially from fishes in general, in the fact that they have no bones, the so-



FIG. 31. — THE SHARK.

called skeleton or frame being formed of cartilage, easily bent, twisted, or cut with a knife. Notwithstanding this, the sharks (Fig. 31) are among the fierce marauders of the ocean, the tigers of the sea, preying upon all

forms of life, not hesitating to attack man if a favorable opportunity is presented. The dogfishes are small sharks

which swim in droves, carrying devastation before them; but the large sharks move about individually and are met with all over the world, even in fresh water. One is found at Bagdad three hundred and fifty miles from salt water. Another lives in Lake Nicaragua. The largest shark is the great Rhinodon, which in the Indian Ocean attains a length of sixty or seventy feet. It is a harmless creature with minute teeth, showing that it preys upon very small animals.

In American waters there is a cousin of this giant in the basking sharks which attains a length of from fifty to seventy-five feet. These sharks have a peculiar habit of lying at the surface, or basking, and at such times can be harpooned. During the last century an important fishery was carried on at Cape Cod. A large school of these sharks was discovered off Monterey, California, in 1898, and their capture attempted by some skillful Japanese fishermen. But a fish which was supposed to be dead having suddenly revived, destroying two boats and killing several of the men, the fishing was given up.

The greater number of sharks prey upon other fishes and are scavengers, feeding upon dead animals after the manner of buzzards and condors. The large, so-called man-eater sharks attain a length of thirty-six feet or more, such a specimen having been taken in Australia. I have taken sharks of various kinds, ranging up to thirteen feet in length and have a high respect for this animal's strength and activity. One which I kept in an inclosure for some months towed my boat several miles before it was captured. It seized the keel in its jaws and shook it as a cat would a mouse; and it required

twenty men to haul it into the inclosure. A hammer-head shark which I hooked and caught at Santa Catalina towed me out to sea and was not stopped until four rowboats were fastened to it.

The hammerhead is a remarkable creature, its head being a perfect hammer in shape, the eyes located upon the extremities. It is a bold and active animal, and the largest specimen ever taken, twelve feet in length, followed the fishing boats and robbed them of fish despite a combined attack against it.

Equally remarkable is the thresher shark (Fig. 32), the upper lobe of the tail of which is almost as long as the

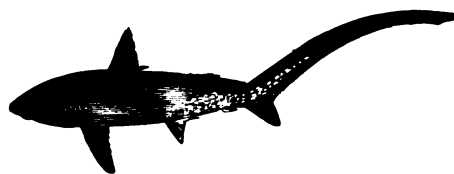


FIG. 32. — THRESHER SHARK.

body of the fish. It is said to use this whiplash to kill small fry and is known to beat the water with it when making its attacks.

It is assumed by many that the so-called sea serpent is a deep sea shark, such an eel-shaped creature having been found in Japanese waters.

Among the small sharks one is luminous over its entire surface; the dogfishes have a spine in front of each dorsal fin, while the little Port Jackson shark, common about Santa Catalina, California, has a peculiar pink nail-like spine in front of each dorsal fin. This shark lies coiled up among the rocks much of the time; its egg is a spiral, leathery object, that is a perfect mimic of the weed in which it lies. These sharks have several kinds of teeth, those in the back resembling crushers.

Among the large forms is the great blue shark, which attains a length of twenty-five or thirty feet. The white shark is even larger, and like it is to be dreaded in the open sea. A huge helpless shark twenty feet long, with minute teeth is common in the Gulf of California, where it is supposed to feed upon kelp. The large sharks often



FIG. 33.—THE SKATE.

follow vessels at sea, eating the refuse that is thrown over. In dissecting a huge shark I took from it several tin cans of meat, that had been partly opened, condemned, and thrown over, three or four hoofs of beeves, an old rope, and part of the skull of an ox with a remnant of the horn attached. A large man-eater caught in Indian waters contained the almost com-

plete body of a horse, — an indication of the shark's enormous appetite.

The rays (Fig. 35), the broad flat fishes with winglike fins and long, slender, whiplike tails, often guarded by spines, are closely related to the sharks. Nearly all live at the bottom of the sea and prey upon the animals found there, as flounders, crayfish, lobsters, and others, which they crush with their singular pavement-like teeth. Most of the small rays settle down upon their victims and endeavor to prevent escape with the enormously developed



FIG. 34. — THE SAWFISH.

side fins which move like wings. The mouth is then protruded and the prey crushed and eaten. The whip rays, black as jet, with a long tail like the lash of a whip, present a very graceful appearance as they glide away over the white reef. In the sawfish the head is prolonged into a sword (Fig. 34), the edges of which have ivory teeth. In capturing its prey the sawfish dashes into the school, striking from side to side, impaling some, cutting down others, then deliberately picking up the pieces. In some instances the saw is six or seven feet in length and twelve inches across, making the animal one of the most formidable of all fishes.

One of the rays, the torpedo, is a powerful electrician, fishermen having been knocked down by its shock. Some are giants and among the largest of fishes.

Such is the devil fish or manta (Fig. 35). One taken in South American waters weighed two tons. Another at Barbadoes required fourteen oxen to drag it ashore, and a naturalist describes one wider than the ship from which he observed it. Specimens from fifteen to twenty feet wide have been observed in the Gulf of Mexico, and small vessels have been towed by them.



FIG. 35. — THE GIANT RAY.

In nearly all, the young are born alive, but some rays deposit curious barrow-shaped eggs of a black, leathery consistence with four filaments which clasp the weed.

Allied to the sharks and rays is the strange *Chimæra*. I have dredged these fishes in deep water in the Santa Catalina channel and kept them alive for a limited time. Over the mouth is a curious clasp ing organ, and the eye is a most beautiful object, large, clear, and a blue only comparable to that of the water in which the fish lives. The eggs of some of these forms are remarkable for their resemblance to seaweed.

DRY-LAND FISHES

Among the fishes none are more interesting than those which spend part of their time out of the water (Fig. 36). When the story was first told of a climbing perch, a fish

that crawled out of the water and remained out of its native element for hours, it was denounced as the fabrication of a practical joker; but now it is known that this little fish not only climbs logs and trees, but migrates across country from one pool to another at will. In

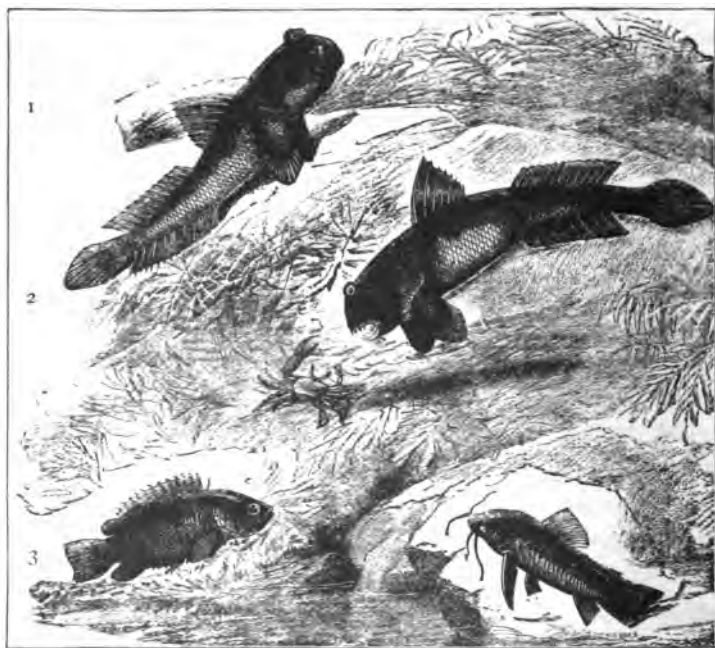


FIG. 36.—1. WALKING FISH; 2. CLIMBING PERCH; 3. CATFISH.

South America.

South America the fish known as Doras leaves the water and by the aid of its pectoral fins, which now appear to serve as legs, it wriggles along in bands of such numbers that they are often followed by birds and other animals, and even the natives capture them at such times.

The migrations of the Doras are for the purpose of securing a better water supply. If the pool in which they live begins to dry up they immediately desert it and wander across the country until a fresh pool is found into which they plunge. The migrations of the climbing perch are undertaken, in all probability, for the same reason, and scores of these fishes have been observed struggling through the grass, wending their way overland. In the climbing perch the gill cover can be moved easily and the spines upon it are used by the fish to aid in its travels. The gill chamber is larger than in other fishes and has gills proper and singular chambers for the reception of air (Fig. 37). The fish can not live upon the air it receives from the water alone. When it is in the water it breathes

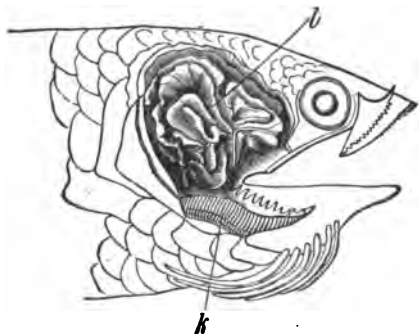


FIG. 37. — GILLS OF CLIMBING PERCH.

by its gills, but when it is on land, or when it rises to the surface, as it often does, it fills the little chambers with air which is taken up directly by the blood vessels. So it might be said that *Anabas* has lungs for breathing air directly, and gills to take it indirectly from the water.

In many parts of the tropics, notably in Africa and Australia, there is a dry season. Pools, lakes, and ponds disappear and with them every trace of animal life. What has been the bottom of a pool, alive with fishes and other animals, becomes a dust-swept, barren depression. Should

a heavy rain come we might well imagine that fishes had been rained down, as the water is soon filled with them. But there is another explanation. The fishes which lived in the pool were hibernators ; in other words, when the water began to disappear they burrowed deep into the mud, formed a case about themselves, smooth and polished

upon the inside, by the aid of their mucus, and there, in what is in all probability an airtight case, they slept during the dry season (Fig. 38), only awakening when the welcome rain came again and dissolved the cell. The *Protopterus*, found all over tropical Africa, is an eel-like creature, attaining a length of



FIG. 38. — LUNG FISH AND ITS BURROW.

six feet, its four fins resembling legs or flippers. The Australian *Ceratodus* is a similar fish which at times leaves the water and wanders through the rushes on the dry land. In Brazil another form, the *Lepidosiren*, is found with similar habits.

The air bladder in these fishes seems to have taken on the functions of a true lung by which they breathe when

out of water, but when swimming they breathe by gills with which they are also supplied. These fishes will live in a moist place out of water a week, and cases of hibernating fish have been sent to England in a trunk.

In these instances the fishes are to a certain extent forced from what would seem to be their native element ; but in the Mauritius Islands and Western Africa certain fishes called gobies (Fig. 39) are found that deliberately leave the water and

wander along the muddy shores in search of food. At this time they use the greatly developed side or pectoral fins as feet and hop along so rapidly that, according to Colonel Nicholas Pike, United States consul at the Mauritius,

it is very difficult to



FIG. 39. — FISHES THAT LEAVE THE WATER.

catch them. He secured his specimens, as he would birds, with a shotgun. There are several varieties of these land-affecting gobies. All have blunt heads and prominent eyes, and all feed along the muddy shores and are seen resting upon the dry roots and trunks of the mangrove trees. Nearly all these fishes require fresh air and are often observed, as the armored gar, rising to the surface ; if forcibly kept below, they would doubtless suffocate.

WEAPONS OF FISHES

The methods of defense with which nature has endowed many fishes afford an interesting study. Mention has already been made of fishes which escape detection by mimicking the bottom, as the sculpins and flounders; there are countless others which are provided with a



FIG. 40. — THE SWORDFISH.

defensive armament, more or less effective. One of the most conspicuous is the swordfish (Fig. 40), whose upper jaw is prolonged into a sword which the fish often drives through its enemies, and sometimes through the oak-bound hulls of ships. Scores of instances could be given, showing the ferocity of these fishes. It is probable that when they strike a vessel, they believe it to be a whale or some other enemy.

The force with which this sword is wielded is terrific, and a single illustration will suffice. The ship *Fortune*, having sprung a leak at sea, was obliged to put into port. When the cargo was unloaded the sword of a large swordfish was found piercing the hull, causing the leak. It had

penetrated (1) the copper ; (2) an inch board undersheathing ; (3) a three-inch plank of hard wood, (4) twelve inches of solid white oak timber, and (5) the head of an oil cask where it stopped, not allowing a drop of oil to escape.

The swordfishes fight one another, and I once found a specimen which had been run through and through. They kill their prey with the sword by slashing from side to side, cutting the small fry into pieces, then leisurely picking them up. After a charge of a swordfish into a school of mackerel barrels of wounded fish have been col-

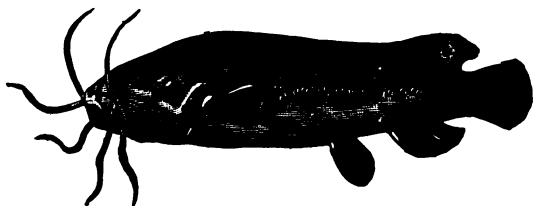


FIG. 41. — ELECTRIC CATFISH.

lected by fishermen. The sawfish, one of the raylike fishes, has a terrific weapon in its sword which has some resemblance to that of the swordfish, and bears upon its sides ivory teeth, which lacerate fishes under the heavy side blows which the fish makes when charging a school.

One of the rays, an eel, and a catfish (Fig. 41) are provided with an electrical apparatus that is an effective armament and protection. The moment the torpedo ray is touched, its curious eyes are depressed and a powerful shock is given, so vigorous a defense that fishermen have been knocked down by it, the shock passing up the handle of the spear which the men were using.

The electric batteries of this fish lie on each side of the

head and resemble vertical hexagonal prisms crowded together, each being a little cell filled with a clear jelly-like substance. Eight hundred of these cells have been counted, and remarkable experiments made. The electric current from the fish will magnetize a needle and can be made to produce a spark. When a circuit is completed, including the fish, powerful shocks can be given to a number of people. When the powers of the fish were first discovered it was publicly used as a cure for many diseases and hundreds of persons received the shocks. The



FIG. 42.--THE ELECTRIC EEL.

upper surface of the battery is positive, the lower negative.

In all about fifteen different varieties of electric rays are known, and they are sometimes the cause of the tem-

porary disablement of fishermen. By its batteries the ray is able to benumb and even kill its prey. The batteries are also used in defense, as the moment a shark attempts to seize one of these rays, it receives a stunning shock. The *Gymnotus* or electric eel of South America (Fig. 42) is provided with an electric armament even more dangerous. The batteries are two pairs of organs just below the skin: one pair back of the tail, and the other near the anal fin. The cells are very small, as many as two hundred and forty being found in a square inch of surface. In the lakes and streams where they abound these eels have been caught at

times by driving wild horses into the pools. The rushing and stamping of the horses cause the eels to resent the attack with such powerful shocks that they are soon exhausted and can be handled. Some of the eels are six feet in length, and the slightest attack by an enemy is sufficient to bring out this wonderful muscular action which takes the form of a violent electric shock.

When white people first visited tropical Africa, they found that some of the natives used a singular test to discover the guilt of suspected persons. The accused party

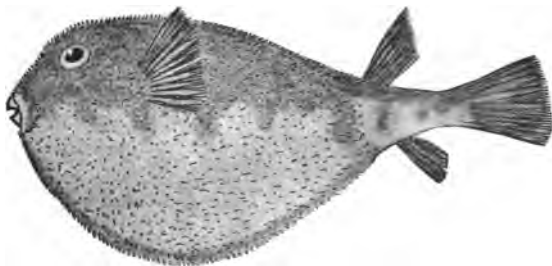


FIG. 43. — THE PORCUPINE FISH.

Inflated.

was obliged to hold a small catfish, and if he could do so without displaying pain, innocence was assumed. The catfish is now known as an electrician and is employed by the natives as a medicine. The entire body of the little fish is covered with electric cells, and the shock is compared to that of a Leyden jar.

In some fishes the scales are developed to constitute weapons of defense. This is well illustrated in the porcupine fish. The first specimen that I caught was in the Gulf of Mexico. When taken from the hook it was about a foot in length, and was covered with long ivory teeth

or spines, all pointed backward ; but in a moment it began to swell, and very shortly was a perfect balloon, as shown in the accompanying illustration, with spines which, like those of the hedgehog, extended in an outward direction. Another fish was dotted with short spines and puffed up in an equally singular manner (Fig. 43). Many

of the fishes are provided with long sharp spines which prevent them from being readily swallowed. The little cobbler fish (Fig. 44) bears such a jagged spine upon its back. The dogfish has a spine in front of each dorsal fin, while the Port Jackson shark is armed in a similar manner. The jagged, saw-toothed darts in the rays are placed at the base of the tail, one above the other, the longest being four or five inches in length and a formidable weapon. The little stickleback is armed with spines projecting in various directions, while the catfishes have an armament of spears which every fisherman has discovered. The weaver fishes have spines on the



FIG. 44. — THE COBBLER FISH.

gill covers, which are very sharp, and while without poison sacs, are very dangerous. The spines of all fishes are their weapons of defense, while their scales, or plates, like those of the armored gar, or sturgeon, and their teeth, are features of their defense which enable them to hold their own in the great struggle for life in which all fishes seem to be involved.

FLYING AND LEAPING FISHES

To enable many fishes which have no particular methods of defense to escape, nature has given them marvelous soaring powers, so well illustrated in the different kinds of flying fishes found all over the world. I have seen, at Santa Catalina, as many as forty or fifty flying fishes (Fig. 45) rise from the water at once; caught by a heavy wind, they were raised many feet into the air, where they glistened like birds and

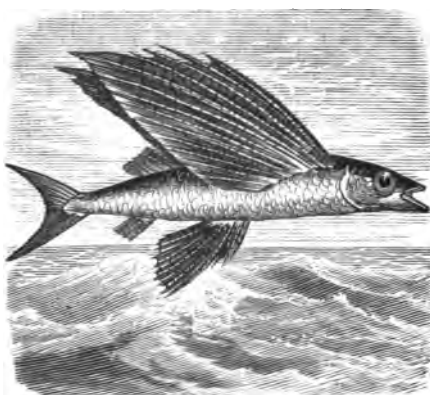


FIG. 45. — THE CALIFORNIA FLYING FISH.

soared away, some disappearing in the distance before they plunged back into the water. This was the California flying fish, the largest of its kind, and capable of soaring a fourth of a mile. The Californian flier is about a foot in length. Its side fins are developed into enormous winglike organs, the rays connected by a delicate web which in the sun resembles glass. The ventral fins also form wings, though very much smaller, so the flying fish really has four wings. But does it fly? I have watched hundreds of specimens during many years, have observed them pass over my boat, have been struck by them, and have seen my companions on more than one occasion hit

by these living missiles, yet I have never observed the fish move its wings after it had fairly cleared itself of the water.

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lands the demand for fish on Fridays alone means the expenditure of millions. To capture this fish supply fishermen have invested their all, and capitalists have formed companies, with thousands of dollars at stake.

Some of the most remarkable fisheries are the American cod (Fig. 47) fisheries on the Grand Banks, several hundred vessels and several thousand men being employed. Gloucester, Massachusetts, is said to be the city of widows and orphans, due to the fatalities on the Grand Banks, as every year there are many wrecks and accidents. The

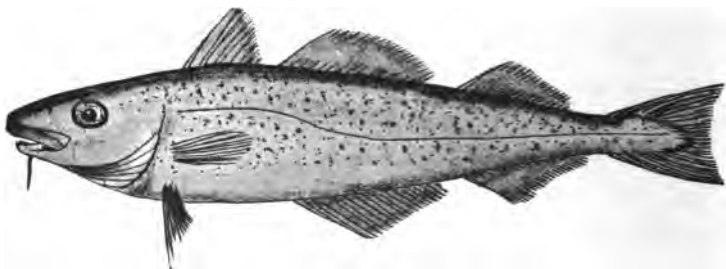


FIG. 47. — THE COD.

cod-liver oil industry alone is one of stupendous proportions, involving thousands of dollars. On the northwest coast the salmon canneries employ hundreds of men, and at various points along our coast and that of England we find sardine and other canneries.

The skin of small sharks or dogfish is made into leather or shagreen, and the oil from the liver is employed in machinery. The natives of the South Pacific islands use sharks' teeth as edges to their swords, while in China shark fins are in demand for the gelatine they produce. From Kurrachee alone the fins of forty thousand sharks are shipped annually, and in one year Bombay has sent

to China eight thousand hundredweight of fins alone, to take which, large numbers of professional sharkers are employed.

The little candle fish of Alaska is used as a light, being fastened to a stick, and when lighted burning with a clear flame.

The sturgeon fisheries of Alaska are very valuable, while those of Russia alone afford employment to a hundred thousand persons. The flesh is eaten, while the eggs as caviare are shipped all over the world.

The mackerel fishery is one of the most important, affording a direct living to a large number of persons on the New England coast.



FIG. 48. — THE REMORA.

The salmon fisheries of Alaska are of enormous proportions, and in one year the owners received from the rest of the world nearly \$3,000,000 in exchange for their catch of salmon, which goes to the support of seven thousand persons in Alaska. In the north the fishes produce food, and the skin of the air bladder of some is used as glass, the bones and teeth in buttons and ornaments, and the oil as light, food, and medicine; in every land men, women, and children are found obtaining a living directly from the fishes.

The swordfish fishery is a valuable one in New England, where a fleet of vessels follow the swordsmen of the sea.

head and resemble vertical hexagonal prisms crowded together, each being a little cell filled with a clear jelly-like substance. Eight hundred of these cells have been counted, and remarkable experiments made. The electric current from the fish will magnetize a needle and can be made to produce a spark. When a circuit is completed, including the fish, powerful shocks can be given to a number of people. When the powers of the fish were first discovered it was publicly used as a cure for many diseases and hundreds of persons received the shocks. The

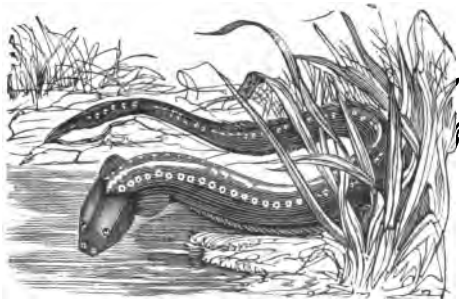


FIG. 42.—THE ELECTRIC EEL.

upper surface of the battery is positive, the lower negative.

In all about fifteen different varieties of electric rays are known, and they are sometimes the cause of the tem-

porary disablement of fishermen. By its batteries the ray is able to benumb and even kill its prey. The batteries are also used in defense, as the moment a shark attempts to seize one of these rays, it receives a stunning shock. The *Gymnotus* or electric eel of South America (Fig. 42) is provided with an electric armament even more dangerous. The batteries are two pairs of organs just below the skin: one pair back of the tail, and the other near the anal fin. The cells are very small, as many as two hundred and forty being found in a square inch of surface. In the lakes and streams where they abound these eels have been caught at

times by driving wild horses into the pools. The rushing and stamping of the horses cause the eels to resent the attack with such powerful shocks that they are soon exhausted and can be handled. Some of the eels are six feet in length, and the slightest attack by an enemy is sufficient to bring out this wonderful muscular action which takes the form of a violent electric shock.

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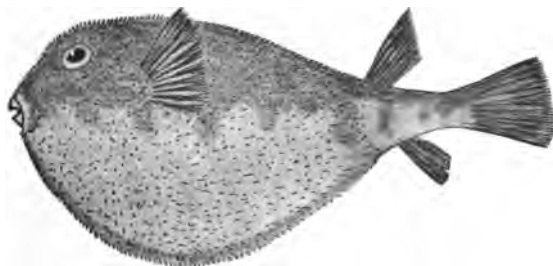


FIG. 43. — THE PORCUPINE FISH.

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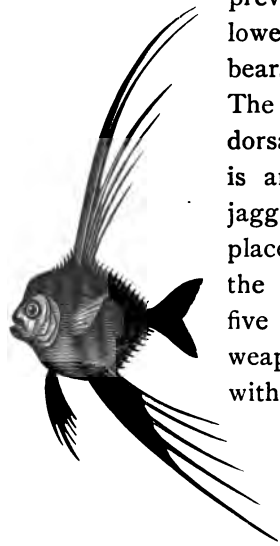


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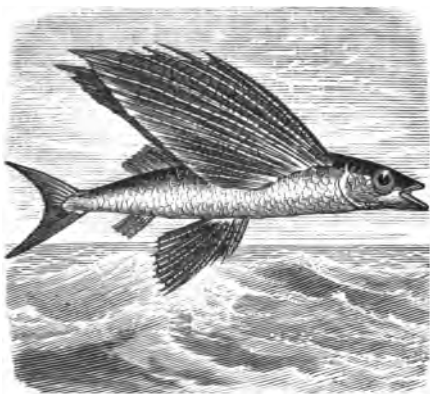


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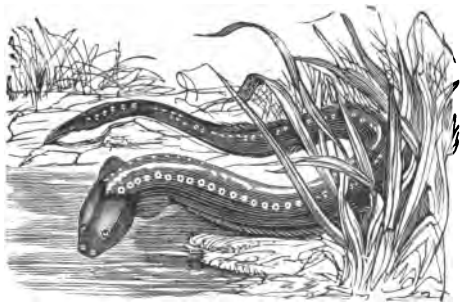


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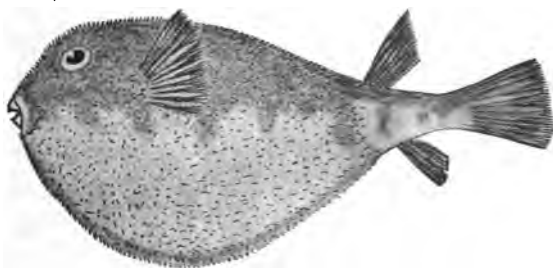


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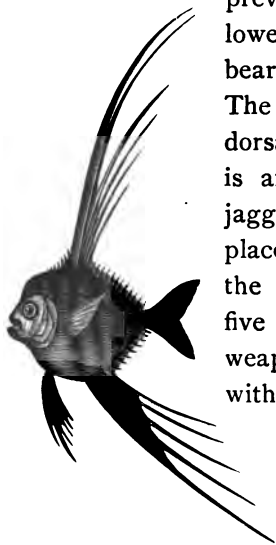


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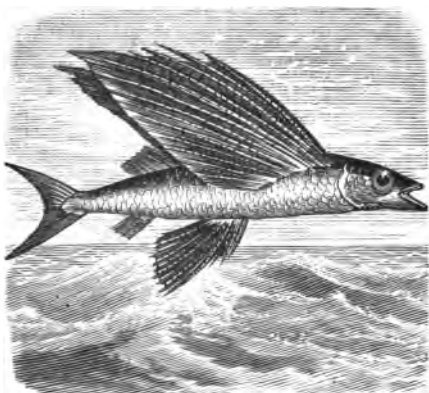


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The fishes which throng almost every body of water have a decided value to mankind. Aside from what is called their commercial value they have their various offices to fill and duties to perform in the plan of nature. The fishes are the direct support of thousands of people all over the world, and the amount of money invested yearly in boats, nets, lines, hooks, rods, and sinkers, if expressed in money, would represent an enormous sum. Fishes constitute an important food item the world over. In some countries fish is the chief article of diet, and in all

bility of this a naturalist had a series of rocks arranged in which the toads could be sealed up. The experiment was carefully carried out, but in no instance did the animals live beyond a few weeks. The fable arose from the habit of toads and frogs hibernating or entering a winter sleep. At the approach of cold their food supply is cut off, and they are threatened with the rigors of winter; so these little animals burrow deep into the earth, the former going down into the mud of ponds, the latter burrowing in the ground anywhere, or entering the burrows of other animals. There they literally go to sleep; their functions are all in abeyance; they do not eat; breathing is almost imperceptible, and they are said to be in a state of hibernation. In this condition they pass the cold months.

The frogs of the tropics enter a similar state when deprived of water. Frogs incased in dry earth, hardened almost to stone, have been found at various times, and the story at once circulated that a toad had been taken from the solid rock, when, if water had been poured upon the latter, it would have dissolved and relieved the toad that, instead of having been a prisoner for a thousand years, entered its seclusion the previous season to avoid a drought or cold weather.

THE SNAKES

In half hours spent from time to time in the forest or along some well-wooded stream the stroller may chance to observe some of the most dreaded of reptiles, the snakes. Nothing can be more attractive when color is considered, yet of all the animal kingdom they are

held in least respect, and it seems to be instinctive in man to place his heel upon a snake. This dislike is due mainly to prejudice, the result of years of superstition, which has produced the milk snake, the hoop snake, and others which exist only in the imagination.

The snakes are in the main valuable allies of man, particularly the farmer, as they devour incredible numbers of mice, gophers, and squirrels which prey on grain. The non-poisonous snakes should never be killed, and there is no reason for the wanton destruction of rattlesnakes in open and barren regions unless the country is being settled by mankind.

In some instances the snakes are so deadly that organized warfare is made against them. This is the case in India, where annually nearly twenty thousand natives lose their lives by cobras (Fig. 62). In our own forests the harmless snakes are usually the ones seen; as the little green snake which mimics the verdure and resembles a vine; or the striped snake, almost invisible along the roadside.

These animals are true reptiles, and are a decided advance upon the batrachians, — the frogs, toads, and salamanders. The features which attract attention are the long, cylindrical body, covered with fine scales, and the absence of limbs. In the poisonous varieties the head is flat



FIG. 62. — THE COBRA.

and diamond shaped, as in Figure 63, *B*, while the non-poisonous forms have a long, slender head, as that of the common garter snake (Fig. 63, *A*).

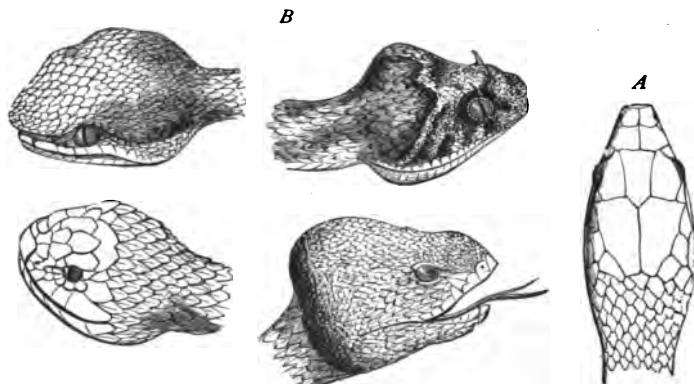


FIG. 63. — HEADS OF SNAKES.

The wonderful mechanism of the snake can best be observed in the skeleton (Fig. 64), which is made up of many vertebræ, often three or four hundred, joined on the ball-and-socket plan. This explains the flexi-

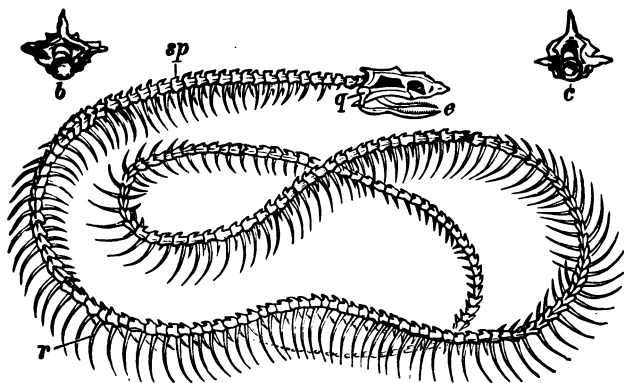


FIG. 64. — SKELETON OF A SNAKE.

bility of all snakes and the facility with which they wind about their prey, forming remarkable folds and knots.

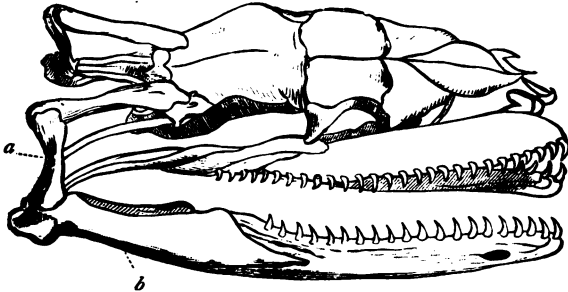


FIG. 65. — HEAD OF A NON-POISONOUS SNAKE.

An examination of the head (Fig. 65) explains why it is possible for a snake to swallow animals so much larger than itself. The secret is that the lower jaw is not firmly attached to the upper, as in man, but the jaws can be stretched apart to an incredible width, permitting a python (Fig. 66) to swallow a small deer. This is owing to the presence of a quadrate bone on each side, between the upper and the lower jaw, which is movable, permitting the jaws to



FIG. 66. — PYTHON.

distend. The teeth in a non-poisonous variety are small, sharp, and conical and point backward. They are used only for holding prey, not for masticating, as the snakes swallow their food entire. The tongue is long, slender, and forked, and is darted out in a rapid manner, especially when the snake is enraged. The eyes have no movable lids; hence the stare of the snake and its expressionless, stony appearance.

Without limbs except rudimentary ones beneath the skin in some, the snakes are among the most rapid movers, darting out of sight with inconceivable rapidity. Some live among trees, swing from them to secure their prey, and suffer no disadvantage by their lack of limbs. They move by successively advancing the large lower scales, the rapid action sending the animal along with great speed. In obtaining their food snakes glide quietly through the verdure, climbing trees for birds or eggs, entering the water for small fishes, and occasionally spending much time in it, as the water snakes, in which the tail is a paddlelike organ. When the prey is seen, they dart upon it with great velocity and endeavor to encompass it in their folds, literally tying themselves into knots about the victim, and crushing it to death. In a few seconds a python or boa constrictor will in this way crush the bones of a small deer. In the case of poisonous snakes the victim is rendered powerless by the poison which issues from a poison sac at the base of the fang (Fig. 67). When the rattlesnake or cobra strikes, the mouth closes, certain muscles press upon the gland, and the poison is forced into the wound. The rattlesnake has a rattle which it sounds; this serves

as a warning to man and beast. In the Northern States the snakes, as well as the lizards, hibernate during the winter, often being found rolled in balls, coming out in early spring in a famished condition.

The snakes lay eggs, either burying them in the soil or sands, or forming a nest on the surface.

The latter has been observed in the rock python, the snake coiling itself about the eggs, which hatch in about fifty-six days. Various snakes when alarmed will receive their young into their mouths. Colonel Nicholas Pike informed me that he had witnessed this act in several snakes, among which were the moccasin, rattlesnake, and garter snake, the reptiles being in a box where he could watch them at short range.

In their habits the snakes are very interesting. The green tree snakes are attractive creatures, mimicking vines and climbing into trees, in search of birds and their young. The activity of these snakes is marvelous. They are usually very long and slender and richly colored, green being the prevailing tint. One of the most beautiful is found in Borneo, where it is a pet in many native households, the children being seen with the reptile wound about their necks and arms. This snake is at home in the highest trees, and rushes through the tree tops in search of prey, swinging from

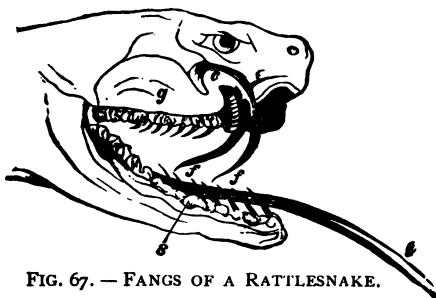


FIG. 67. — FANGS OF A RATTLESNAKE.

Showing poison sac, *g*.

off evenly at one of the joints and now seemingly possessed with independent life. By the watch it leaped and squirmed nearly a minute.

Time and again this experiment was made, the lizards, when violently startled, tossing off their tails, a move undoubtedly intended to attract attention to the leaping tail, while the body ran away. This body would not be

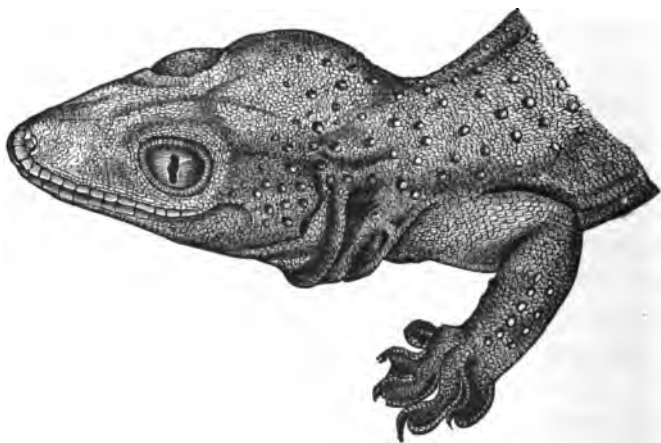


FIG. 69. — HEAD OF THE GECKO.

tailless for evermore, but would grow another tail in a few months.

Among the collection made of living lizards there were some with tails of all sizes, from stumps to those almost completely grown, the original tails having been lost in all probability while endeavoring to deceive some enemy, and doubtless many a road runner had been forced to put up with a tail instead of a lizard. The little gecko (Fig. 69) throws off its tail at the slightest warning, and as it

strikes the ground, leaping and tumbling about, its owner has been seen to turn, rush at it and devour it, thinking it a worm possibly, paying a tribute to the success of its own device of tail throwing.

The lizards are remarkable for the rapidity of their movements, and when in a tree it is almost impossible to follow them, so quickly do they move or adapt themselves to the color of the limb or leaf upon which they rest. This is particularly true of the lizard shown in Figure 70,

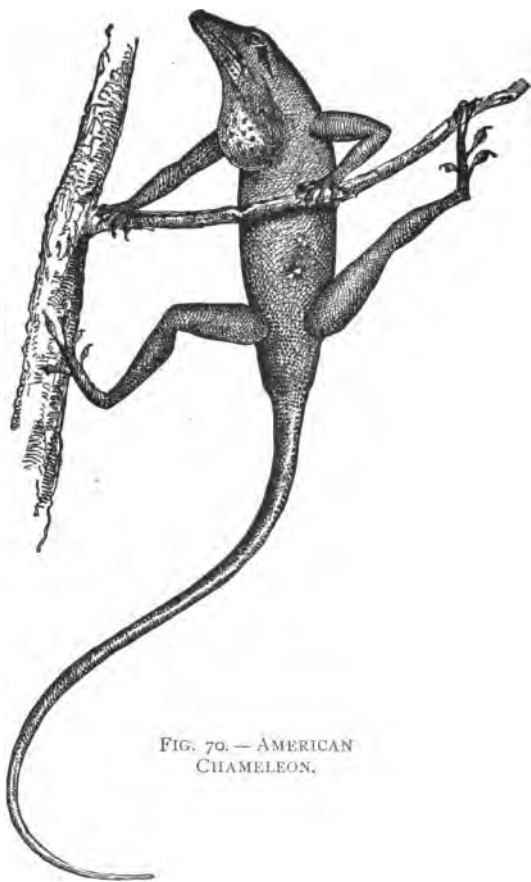


FIG. 70. — AMERICAN
CHAMELEON.

the American chameleon. I once kept several of these little creatures, and the marvelous tints and colors of green and brown they would assume were a constant delight. They became very tame, ate flies and various insects from

the hand, and ran over me with impunity. One would sometimes rest on my hand as I wrote, its cunning eyes watching every movement.

The skeleton of the lizard is shown in Figure 71, and an examination will show that it is decidedly an advance upon that of the snakes. The jaws are not extensible as in the latter, hence the lizard is confined to small insects, which are crushed by its sharp conical teeth. The tongue

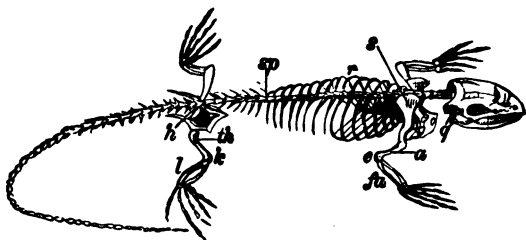


FIG. 71. — SKELETON OF A LIZARD.

is long and snakelike, often forked. With few exceptions the lizards deposit eggs, and despite popular prejudice all, with the exception of the Gila monster or *Heloderma*, are harmless.

The Gila monster is found in Arizona, New Mexico, and Lower California. It is about two and a half feet in length and very sluggish, specimens when handled often refusing to move even when pushed along. They seem to prefer the hot, burning sands, and live upon such insects and small animals as they can capture there. That the bite of this lizard is dangerous has been proved on many occasions. An acquaintance of mine had tied a specimen to the back of his Mexican saddle, when, throwing his arm around, the creature seized his thumb in a bulldog-like

grip. Release without assistance was impossible, and the victim made a heroic ride to the nearest town, having a narrow escape. Animals, as rats and rabbits, die in a few moments after being bitten by the heloderma, the poison, unlike that of the rattlesnake, paralyzing the heart. The teeth have fissures ; but poison ducts have not been found.

One of the most attractive lizards is the blue-tail, which I have often found along the base of the Sierra Madre Mountains. Its body is brown and green, the tail a beautiful turquoise-blue, a most conspicuous object. This lizard is so rapid



FIG. 72. — THE CHAMELEON.

and agile in its movements that it is rarely captured. The tail in nearly all lizards is a very conspicuous object, generally long and snakelike, often aiding the lizard in mimicking a vine ; again, as in the chameleon (Fig. 72), acting as a fifth limb, clinging to branches and serving the same purpose as that of the ringtailed monkey. These lizards are very slow of motion, relying for protection upon their marvelous power of changing color. Quite the reverse is the Iguana, one of the swiftest and largest of

all lizards, attaining a length of five feet. Its tail is its weapon of assault, the animal when enraged swinging it around with force sufficient to inflict severe injury.



FIG. 73. — IGUANA CROSSING A RIVER.

Observed by John G. Bell.

In Figure 73 is shown a drawing made from a sketch after a description given me by the late John G. Bell, an old friend of Audubon. Mr. Bell, to illustrate the rapidity of motion of the iguana, stated that he once



FIG. 74. — THE SKINK.

startled an iguana on the side of a river, and that it dashed into the water and crossed it literally upon the surface, holding itself in the position shown by the rapidity of the movements of its feet. The toes of the iguana are extremely long and slender, very unlike those of the little

skink (Fig. 74), which are short and of little service. On the other hand, the geckos (Fig. 75) have toes provided with adhesive plates by which they cling to walls, having a seemingly marvelous faculty of running along overhead. This is true of many lizards, nearly all having delicate plates or disks which act like suckers, some exuding a sticky secretion by which they readily run along, even on the polished surface of glass.



FIG. 75. — THE GECKO.

The foot of the chameleon (Fig. 76) is adapted to clasping, and resembles some mechanical contrivance. Indeed, the entire animal has little or no appearance of life. Clinging to the limbs, its staring, unmovable eyes looking into space,



FIG. 76. — TONGUE OF CHAMELEON.

it seems to be a weird caricature of an animal, but suddenly out of its mouth shoots an extraordinary object, almost as long as the chameleon, — its tongue, — which strikes and secures its prey with absolute surety.

An interesting mimic, though not in the sense of rapidly changing its color, is the so-called horned toad, which is really a lizard. The animal is seen in Figure 77 as one

usually observes it from above, a curious flat object seemingly covered with spines, those on the head being particularly long. The lizard is brown, yellow, and white in color, adapting itself to the tint of its surroundings. When touched it flattens out, and is not a pleasing object, yet it is perfectly harmless. The spines are not used, and the little lizard makes an interesting pet, if the term can be applied to mere possession. I have experimented

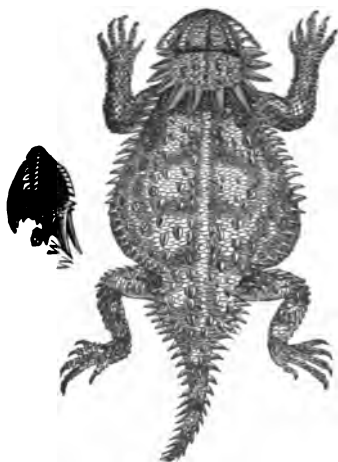


FIG. 77. — HORNE LIZARD.

with them in the manner described at the beginning of this chapter, placing them in different compartments, where they soon adapted themselves to their surroundings. They do not assume black or white tints, but the change is sufficient to afford them abundant protection. On the mesas of Southern California they are not uncommon objects of the roadside, those in the road resembling its dusty hue, while those among the brush are of a brighter tint. In the spring they deposit their eggs in the sand and desert them, the young appearing later, darting here and there among the verdure, minute editions of the parents.

The horned lizard has no defense if one remarkable performance may be excepted. I noticed it first when my dog, a fox terrier, had caught one. The dog was rubbing his nose in the sand and evidently annoyed, if not

hurt. The lizard had done something, but what? The dog was urged to approach it again, when the little lizard lowered its head and with a convulsive movement threw from its eyes or the eyelids a dark, bloodlike fluid. At first it was difficult to tell positively where it came from, but the eyes of the lizard were suffused with blood, or bloodshot. A piece of paper was then held up before the lizard, which soon discharged a volley of the fluid from its eye or lid, striking the paper with some force, a distance of a foot. On several occasions this was observed. A dealer who has handled thousands of lizards stated that he had seen them eject the fluid a distance of five or six feet. Whether this is intended as a defense or not it would be difficult to determine, but in effect it was sufficient to demoralize a dog, and in the meantime the lizard, by a curious side-shuffling movement, disappeared beneath the sand.

Lizards are interesting pets. Those I have kept in confinement displayed no little cunning. They often pretended to be dead; the eyes would be closed, the legs drawn in, and the lizard could be lifted and dropped upon the sand without movement. The deception was perfect. There was but one weak point. The lizard was very ticklish, and when scratched, it immediately gave evidence of life, lifting that side higher and higher until it presented the comical appearance of standing upon its side with two feet in the air. At other times, when it thought it was not observed, it would dash away with the greatest speed, stopping the moment it was discovered, trusting then to its resemblance to the soil.

Running constitutes the principal movement of the

majority of lizards, but a few appear to soar and have an especial arrangement which enables them to sustain themselves in the air. This is particularly true of the flying gecko, which has winglike expansions on its sides, including the head, body, and tail, a sail which expands when the animal leaps into the air, holding it up like a parachute after the manner of the flying squirrel. These lizards are very attractive in shape and color, and when darting through the air they resemble gorgeous insects.



FIG. 78. — FLYING DRACO.

A better adaptation for soaring is seen in the dracos (Fig. 78), commonly called flying dragons. They have a veritable pair of wings extending on either side of the body, as shown. These are folded when the animal is not moving or lying, as is its custom, on a limb; but does an insect appear, the lizard bounds into the air, one of the most gorgeous objects of the East Indian forests, and with wings extended it soars from tree to tree in pursuit of its prey, resembling a bird of radiant plumage. One of the lizards most remarkable for this is the frilled lizard of Australia, which has a curious frill beneath and around the head, which it raises when alarmed. Another lizard, the moloch, is completely studded with enormous spikes or spines, the porcupine of the group.

An illustration of the wide distribution of lizards is seen in those of the Galapagos Islands, near the equator, about

five hundred miles west of South America. Of the two kinds found there, both live on vegetation; but one lives along the shore, rarely leaving it, feeding on seaweed, while the other never approaches the ocean, and subsists on cactus. The sea lizard can remain an hour below the surface, is black in color, and about three feet in length, an inoffensive creature. The land form of the same lizard is very sluggish; it lives in caves, and when feeding has been known to drop asleep and allow birds to perch upon its back without objection.

Among the giants of the tribe are the true water lizards found in Asia, Africa, and Australia. The Indian water lizard

is often four feet in length, the tail being long and very slender. It frequents the river banks, and is hunted by the natives, who have dogs trained for the purpose. When cornered it often turns on its pursuers and makes a desperate resistance. The monitor, one of the largest, attaining a length of five feet, is found along the Nile, where it preys upon the eggs of crocodiles and does much to keep these dangerous animals in abeyance. Among the lizards are the so-called glass snakes (Fig. 79), which have no feet. Popular fancy has endowed them with miraculous properties, one of which is that when attacked the animal breaks in many parts and separates

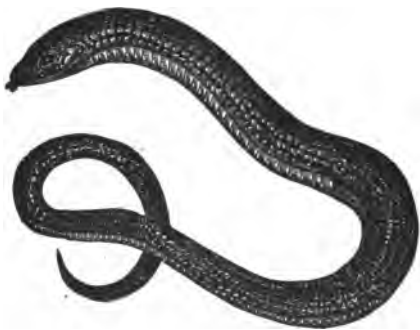


FIG. 79. — THE GLASS SNAKE.

to join later on. It is needless to say that this belongs to the realm of fiction.

The strange double walkers (Fig. 80) are lizards without

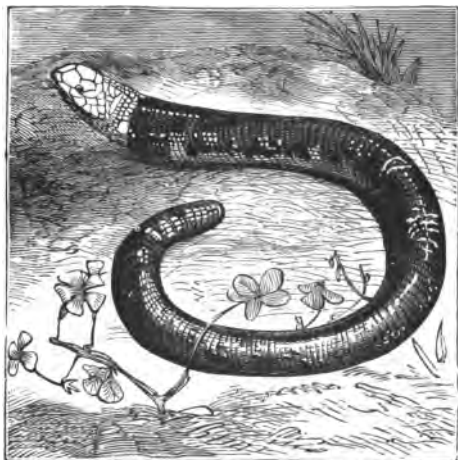


FIG. 80. — THE DOUBLE WALKER.

feet, which have a singular habit of running backward with all the ease which they display in wriggling ahead. Nature seems to have been profligate in the multitude of forms with which these animals are endowed, ranging from the Iguana to the helpless Chiotes, with the body shaped

like a worm with two miniature limbs near the head.

THE TURTLES

The first impression obtained by looking at a turtle is that it lives in a box, especially if the example is the common box turtle (Fig. 81), which goes lumbering along until touched, when it drops heavily from its pedestal of feet, the latter, its tail, and head all disappearing as though by magic beneath a domed shell, which is a barrier and protection against almost every enemy.

The boxlike nature of the turtle is better shown in the skeleton (Fig. 82), in which the frame of the animal is seen. A marked difference is observed between the skeleton of the turtle and that of the lizard. The latter is light, and the bones are slender, but that of the turtle is short, the



FIG. 81.—THE BOX TURTLE.

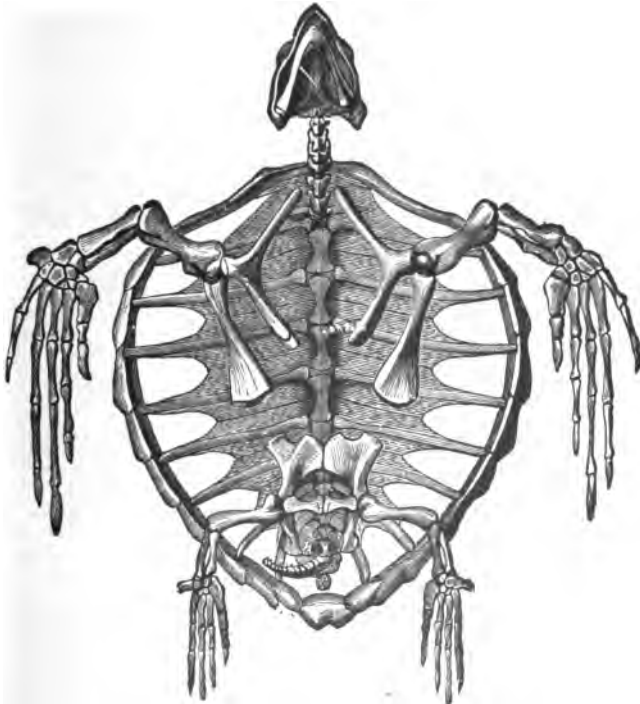


FIG. 82.—THE SKELETON OF A TURTLE.

bones are not only heavy but nearly all seem to be connected, or fused together, giving the animal great solidity, so that it can not bend its back in any way, the only movable portions being the limbs, head, and tail. In

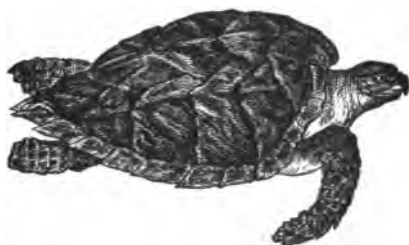


FIG. 83.—THE HAWKBILL TURTLE.

a word, the turtle appears to be boxed up. Over its back it has a shell formed of scales of a horny consistence, as in the hawkbill (Fig. 83), often of great beauty when polished; or the shell is soft, as

in the soft-shelled turtle. The ribs, instead of being light and flexible, are broad and joined together and in turn covered by the shell, the entire upper portion being called the carapace. Below this are the intestines, which are protected by another box cover, a large horny breastplate called the plastron. The position of the latter is seen in Figure 84, which shows the plastron made up of ten plates fitting together into the shell, or carapace, of a box tortoise.



FIG. 84.—THE LOWER SHELL OF A TURTLE.

The head of the turtle is wedge shaped, the powerful jaws being toothless, but provided with horny beaks like those of birds, with which they do great execution. The eyes are provided with an upper and a lower lid, and

a third like that of birds, called a nictitating membrane, which is semitransparent and moves over the eye as a

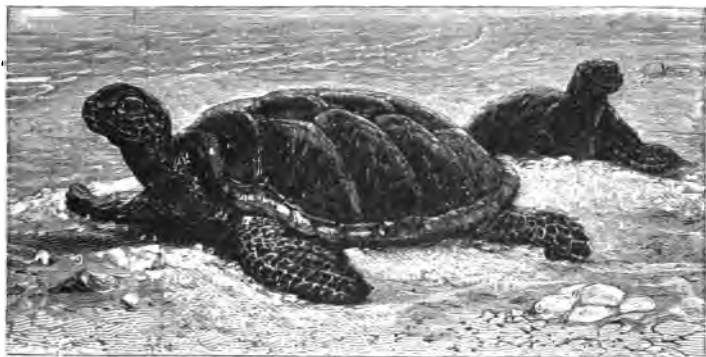


FIG. 85. — THE ATLANTIC GREEN TURTLE.

protection possibly from the glare of the sun. The lungs are well developed, air being gulped down, and the other organs are similar to those of the cold-blooded animals.

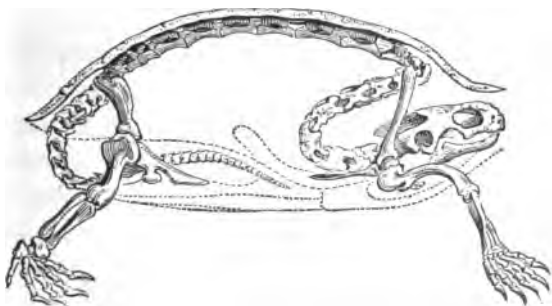


FIG. 86. — SECTION OF A TURTLE.

The turtles are widely distributed, being found in the desert, in secluded pools, and far out to sea. The marine forms are the largest. They have well-developed flippers for swimming and are entirely at home in the water. The

flippers of a swimming turtle are shown in Figure 85, while those of a land form are seen in Figure 86. In this figure is also shown the position of the neck bones when the turtle withdraws its head, being doubled in a U shape. Among the sea turtles the green turtle (Fig. 85) is the most valuable. It is a large and vigorous animal, weighing from two hundred to eight hundred pounds.

In early spring, or May, they come ashore at certain islands to lay their eggs, selecting moonlight nights. If the coast is clear, they climb up the beach to a point above high water, and there dig a hole with their flippers two or three feet deep, in which the eggs are laid, covered, and then deserted. The turtle displays more or less skill, as she never returns to the water directly from the nest, so that she can be trailed, but crawls along the sands and descends a hundred or more feet away. At such times I have lain on the sands with a companion, waiting until the turtles reached the high beach, then springing out to seize them. Once on their backs, the animals are helpless.

Figure 85 gives an excellent view of a certain green turtle as it crawled along the beach. The moment the enemy was observed it turned and scrambled for the water. Seizing it by the ridge of the shell between the flippers, the turtlers tried to lift it, sometimes upsetting it at the first trial, again being knocked over or dragged along by the powerful animal, which finally escaped, as a seven-hundred-pound turtle can carry two men or more upon its back. I have struggled with many in this way on the beautiful moonlight nights among the Florida Keys, but never was bitten, nor did I ever see a green turtle display the slightest anger or resentment. The animals devoted

their energies to escape, beating the sand with their flippers. On a certain island a large one escaped from a party of three. On the reef the green turtles were served as "beef," and dozens were kept in corrals until needed.

The prevailing method of taking green turtles on the open reef is by pegging. The turtles are found sleeping on the bottom of shallow lagoons, standing out in high relief, or feeding upon certain seaweed, occasionally rising to breathe. The boatman sculls his dinghy carefully up to the animal and, as it rises, hurls his long-handled spear. The latter is a three-sided, pointed peg; this enters the shell and is retained by suction, the turtle holding by the long line to which the peg is attached. This method of taking the animals is harmless, as the turtles are uninjured. Many of those shipped to the North as food are caught in this way.

The eggs of the green turtle, as those of all the others, are hatched by the sun, and the little ones immediately make their way to the water, where many of them fall victims to predatory birds and fishes. The baby turtles, though not over an inch or so in length, have no little intelligence. I once kept twenty or thirty on the floor of a room, one end of which overhung the water, from which led a door. The turtles in some way knew that this was the "water end," as they congregated about it, all ready to fall overboard when the door opened. When they were taken away, they immediately returned. The green turtle ranges from Brazil to Cape Hatteras and on both sides of the continent, but its home is in the warm waters of the tropics, a favorite nesting place being Loggerhead and other keys of the Tortugas group.

Uglier than the green turtle and built on clumsier lines, is the loggerhead, often taken on the Florida reef. This turtle is the bulldog of the tribe, and will bite when enraged, but it has little chance with the large sharks. One specimen, which was caught, had all its flippers bitten off in a struggle with the marauders of the Gulf. Its habits are similar to those of the green turtle, and it is turned on the beaches at the same time; but it is a flesh eater, as is the hawksbill (Fig. 83), though not entirely. A specimen that I kept as a pet would eat conch meat and seaweed with equal avidity. This specimen was found floating on the surface of a lagoon on the outer reef, its head wound with the blue tentacles of the physalia or Portuguese man-of-war, which had stung it so severely that it was helpless and apparently paralyzed. In the illustration the large and beautiful scales may be seen, which are often taken from the living turtle — a cruel operation — and later made into combs and the many objects in which

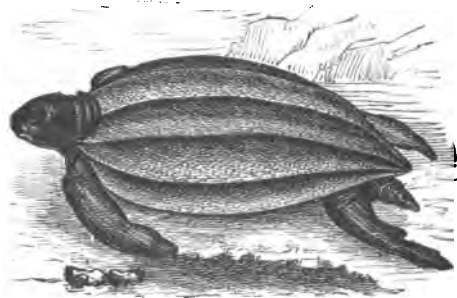


FIG. 87. — LEATHERBACK TURTLE.

tortoise shell is employed. This is the turtle that is caught by the fish remora, referred to in a previous chapter.

The rarest and most interesting among the sea forms is the

leatherback turtle (Fig. 87), which lives on the high seas. It is the giant of the tribe, attaining a weight of

over one thousand pounds. Its back has a leathery appearance, is without scales, and has pronounced longitudinal ridges which add to its singular appearance. The animal is rarely seen. Some years ago a specimen six feet in length was captured in Burmah, but not without a struggle. It dragged six men down to the water's edge from its nest, where it had been surprised, and was conquered only when twelve fishermen seized it. The nest, when examined, held one hundred eggs, each being one and five eighths inches in diameter.

With the exceptions above mentioned, the turtles are confined to fresh-water streams and pools. Stealing through the trees and carefully approaching some pond, one may watch the turtles of various kinds, some upon the muddy shore, but most upon submerged logs or masses of vegetation, where they have crawled to bask in the sun. Many are richly marked in yellow, red, and black; some have light domed shells, like the box turtle; others are flat. The soft-shelled turtle is an interesting example of the latter, its shell being soft and reminding one of India rubber. These have long necks and pointed noses, which are often seen moving to and fro above the mud, not unlike the heads of snakes. Specimens which I have taken in the St. John's River, on a common fishing line, were over fifteen inches in length, vicious



FIG. 88. — SNAPPING TURTLE.

creatures, calling to mind the snapping turtle (Fig. 88), the most aggressive of the tribe. One kept in confinement

displayed the most vindictive disposition. Its long, snake-like neck was miraculously curled in the shell, but when the animal was angered or disturbed, out would shoot the extraordinary head, the ferocious jaws biting with all the vigor of those of a bulldog, taking pieces out of the oar or stick that happened to be in the way, and holding on with a tenacity born of brute strength.

Turtles undoubtedly live to a great age. One, a box turtle (Fig. 81), marked in 1760, or about that year, was found on the same estate one hundred years later, the marks or initials still being visible. Similar instances are well known.

The terrapin is one of the most valuable of the small turtles; the musk turtle is the most disagreeable, as it possesses a strong musklike odor. This little creature is almost always covered with a growth of long green grass, which has the appearance of hair and which serves to conceal it. The common gopher turtle is found far out on the Florida reef, four or five specimens living on Garden Key. A similar form is found on the arid Californian desert, where it lives on cactus and other vegetation, probably rarely seeing water. This turtle, though not over eighteen or twenty inches in length, has not only borne a man's weight, but carried one along the floor.

South America, especially the swamps of the Amazon, is the land of turtles. Here they are found in vast numbers, some attaining a length of three feet. So plentiful are they that they constitute an important feature of the food of the natives, regular weekly hunts being organized, each house having its turtle corral. Nearly all the turtles are protected by their resemblance to their surroundings,

even the desert tortoise resembling a rock. But the most remarkable example of a protected form is seen in the bearded turtle, *Chelys matamata*. Its shell is made up of remarkable pyramids ; its neck is very long and snakelike, and covered with excrescences which resemble plants, the head is pointed and recalls that of a guinea hen more than anything else, having a pointed, beaklike nostril and curious, earlike appendages. This queer turtle conceals itself in the mud or bushes, with its head standing upright among the vegetation, so cleverly imitating it that few animals would detect the imposition ; but if a young bird or small animal pass within reach, the strange plant shoots out at it with great velocity and with a fatal result.

The turtles are all valuable to man. Many serve as food, while the greater number are scavengers, many a forest pool being kept pure by the little turtles that inhabit it.

THE CROCODILES

The crocodiles are so associated with the Nile and the Ganges, where they attain an enormous size, that it is a



FIG. 89. — HEAD OF A FLORIDA CROCODILE.



FIG. 90. — SKELETON OF AN ALLIGATOR.

surprise to some to learn that there is a true crocodile in America, especially interesting from the fact that it is partly a salt-water form, having been seen out on the reef evidently on a fishing expedition.

The head of one of these reptiles is shown in Figure 89, taken from the photograph of a specimen which caused the captor no little trouble. The animal was fourteen feet in length and was speared and hauled into the boat. It was so large that the seat was taken out and placed on its body, on which the harpooner sat as he rowed to camp, delighted at taking so large and fine a specimen. But the crocodile was "playing possum," as it suddenly renewed its life and activity, and with a single sweep of the tail cleared the boat, tipping it over, only to be caught again after much difficulty.

The crocodiles are water animals, with powerful jaws, in which the large teeth are firmly fixed; the tail is long and powerful, well shown in the skeleton (Fig. 90), a perfect swimming and defensive organ; the four legs are adapted for either walking or swimming, the claws being

more or less webbed, as shown in Figure 89. The body is incased in a skin made up of plates, as seen in this figure. The heart has four chambers; the eyes and ears are protected by movable lids. Thus endowed with powerful teeth, prodigious strength, and a long and powerful tail, the crocodiles are animals to be dreaded.

They are found in the tropical and semitropical regions of many countries and are divided into three distinct classes which are readily recognized. First comes the gavial (Fig. 91), the most dangerous of the race, with long, slender muzzle filled with sharp and powerful teeth. This reptile attains a length of twenty feet, and in many of the rivers of India is a veritable man-eater.



FIG. 91. — THE GAVIAL.

Crocodiles are found in almost every continent, even in some of the great islands, as Hayti, but they are at home in the Nile and around the equator, where, in places, they literally swarm, the muddy banks of streams being covered with them, of all sizes up to twenty feet. They lie in the water by the banks, with their noses just above the surface. When an antelope or other animal approaches, the reptile sinks and swims beneath the water, then with a rush seizes the unfortunate creature by the nose and hauls it under. Human beings are sometimes seized on the river bank, and children have been knocked into the

water by the crocodile's tail, while men swimming streams at night are sometimes victims of the man-eaters. I once observed the method of attack of a large alligator, which illustrates that of the entire group. A man approached it from behind, when, without warning, the animal struck him a violent blow just below the knees, hurling him in the



FIG. 92. — OPEN MOUTH OF A CROCODILE.

direction of the wide-open mouth, which was turned to meet him. The man was not bitten, but it is easy to conceive that he might have been knocked into the animal's mouth.

The crocodile lays eggs which it deposits on the moist banks of swamps, where they are often hunted (Fig. 93). An interesting bird is associated with the crocodile of the Nile. It is called the Nile bird, and performs a valuable service to the great animal; that is, ridding its mouth of the flies which infest it. When the crocodile comes out

to feed, its unsavory prey attracts millions of flies, and after the feast the animal opens wide its jaws, which appear as in Figure 92. The little bird, *Pluvianus ægypticus*, hops into the dreadful mouth which spares no other creature, and begins to devour the troublesome insects, rarely or never being molested by the crocodile.

The West Indian crocodiles, or caymans, have been known to attack people, but they are by no means so ferocious as the Indian and African species. They were formerly very common in the West India Islands, but rarely attained there a length of over twelve feet. The eggs were deposited in the sand and covered, the female watching them to some extent, and at times uttering a cry like the barking of a dog, especially when the young were appearing (Fig. 93).



FIG. 93.—YOUNG CROCODILE LEAVING THE EGG.

In Jamaica crocodiles eighteen feet in length have been measured. A certain ranch at St. Thomas had been devastated at times of its small live stock by a cayman, and every method had been tried to kill it, but to no purpose. It was reported to be the largest one ever seen on the island, and had become very proficient in snapping up birds. The animal was shot several times, but always

escaped. One night an African met the crocodile face to face, and probably having in mind the reward which had been offered, sprang at the animal before it could turn, landing fairly upon it, seizing its fore legs and lifting them over its back. This threw the cayman's nose into the sand and rendered it helpless. In vain it struck powerful blows with its tail and endeavored to leap. The man kept his seat and resolutely held the helpless animal until help came, when it was shot through the head.

The alligator is the third type of crocodiles, and a familiar animal in America, being found in numbers in the

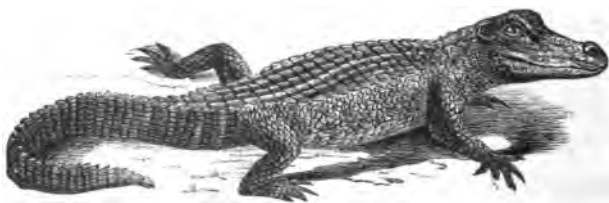


FIG. 94. — THE ALLIGATOR.

Florida swamps, where it is so assiduously hunted for its skin that its extinction is only a matter of time. In general appearance it resembles the crocodile, and twenty years ago I saw the shores of the St. John's River dotted with them, where now they are almost unknown. The alligator is found in the swamps of the Gulf States, lying on the shore during the day, with its head toward the water, ready to slide into it at the slightest warning. Much of its time is spent basking in the hot sun, but at night it is active, swimming about after its prey, the various small animals and fishes. So active is the alligator that it can capture large fishes with ease. It is very partial to

dog meat, and it is said that the barking, yelping, or whining of a dog will attract alligators from far and wide. When the prey is seized, the alligator holds it firmly and sinks to the bottom, allowing the animal to drown, and then devours it.

BIRDS

THE BIRDS

Of all the animals the birds appeal to man as the most beautiful and companionable. This is due to the fact that they are always before us, the most humble dooryard being the resort or home of one or many different kinds.

The birds are the companions of man and serve a benign purpose, beautifying the forest glades with their tints and colors, and filling the air with the melody of their song. Birds are found almost everywhere, from the equator to the farthest north, or the shores of the Polar seas, and are everywhere valuable allies to man. They have many resemblances to the reptiles, but differ from all other animals in a single particular—their bodies are covered with feathers instead of hair. If we hold a bird and some other animal of the same size in the hand, we are at once impressed with the difference in weight; the bird is much the lighter. To explain this we must glance at the skeleton of a typical bird (Fig. 95); here we see that the skeleton appears to be built for lightness. The bones, which in the mammals are filled with marrow, are hollow—so many air chambers to aid in floating the bird in the air.

The spine is light. The bills, except in certain extinct

forms, are toothless, and adapted to the wants of the owner (Fig. 96). Some are short; some long, like those of the humming bird; others curved and powerful, as in the vulture. In moving the lower jaw of a bird we find that it

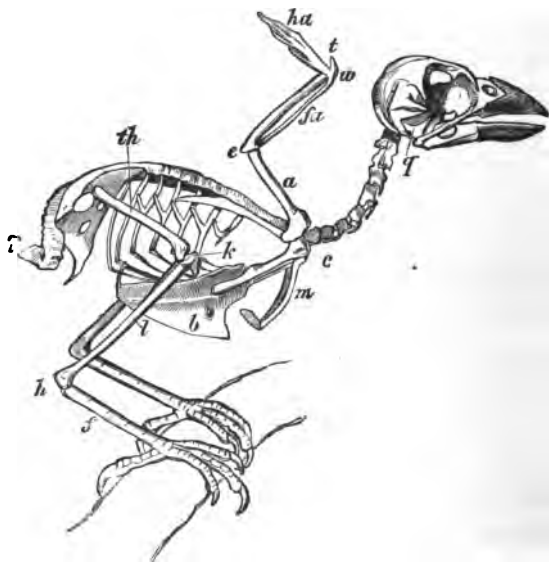


FIG. 95. — SKELETON OF A SPARROW.

q, quadrate bone, peculiar to reptiles and some *amphibia*; *b*, breastbone; *m*, merrythought or collar bone; *c*, coracoid bone, over which the tendon works to pull up the wing; *p*, plowshare bone, on which the tail grows. Wing bones: *a*, upper arm; *e*, elbow; *fa*, forearm; *w*, wrist; *t*, thumb; *ha*, hand. Leg bones: *th*, thigh bone; *k*, knee; *l*, lower part of leg; *h*, heel; *f*, foot.

is not attached to the skull as in the mammals, but to a bone (*q*), called the quadrate — in this resembling the reptiles.

The neck is made up of from nine to twenty-four separate bones or vertebræ, so deftly connected that it can be twisted in almost any direction. This remarkable pro-

vision of nature enables the bird, having no hands, to preen its feathers on any part of its body, and explains the faultless neatness noticed in almost all birds. The dorsal vertebræ, which constitute the back, are joined together in the flying birds, thus giving stability to the body. In the non-flying birds, as the emu and ostrich, their bones move one upon another. The tip end of this chain of bones is

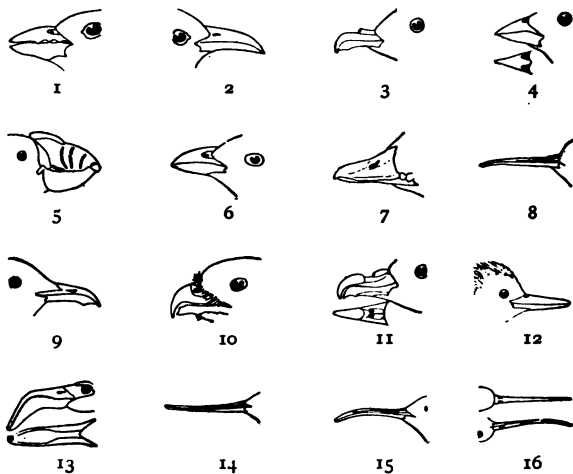


FIG. 96.—BEAKS OF BIRDS.

called the tail, and the bones which connect the backbone to the tail are joined together, being called the sacrum. This, joined with other bones, forms what is called the pelvic arch, which, assuming that we are following the parts of the skeleton in order, leads us to the limbs, which are attached to it.

The fore limbs of birds, which correspond to the arms of man, are adapted to flight and as weapons. The thigh is

attached to the pelvic arch; then comes the tibia and its small fibula. The knee (*k*) is very high. The foot (*f*) has two, four, or five toes. The latter vary even more than the bills, ranging from the clutching claws of the eagle to the swimming foot of the duck, and from the clinging claw of the hawk to the scratching apparatus of the hen. Some of these claws or feet in their variety are shown in Figure 97. How a bird can cling to its roost or perch and sleep would be a mystery did we not know that it has a peculiar

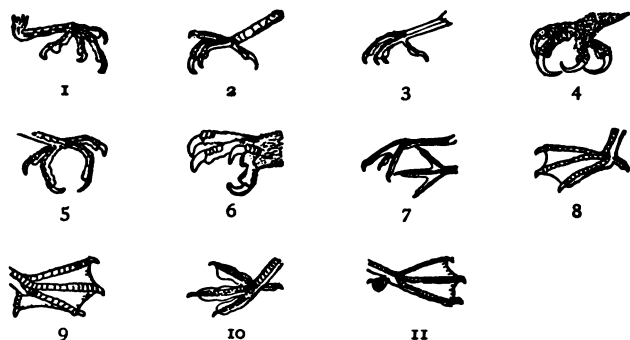


FIG. 97. — CLAWS OF BIRDS.

arrangement of muscles, which, when the bird is resting, draw the claws tightly about the perch.

The bird's tail ends in the plowshare bone (Fig. 95, *p*) and supports a wonderful array of feathers, resplendent in the peacock or trogons, and sometimes six or eight feet long in the cock; a specimen in the American Museum having a remarkable tail many feet in length. The breastbone or sternum (*b*) is one of the largest. To this the wing muscles are fastened, and in the flying birds, where great muscular power is desired, it is said to be keeled to offer a greater

surface ; but in the birds like the ostrich, which do not fly, it is flat. The "lucky bone" is formed by the clavicles (*m*) and near them we see the arm, or wing bones. The elbow is at *e*, the wrist at *w*, and there is a rudimentary thumb which supports what is called the false wing. This portion of the wing corresponds to the hand, and three rudimentary fingers may generally be found, agreeing with the first and third fingers of a man's hand. But the "hand" is now used for an entirely different purpose. It is provided with soft, pliable, fanlike objects called feathers, by which the birds dart through the air and sustain themselves during long journeys.

Without feathers the bird would be a pitiful object ; but clothe it, and we have one of the most beautiful of all animals. The feathers are colored, with a marvellous array of tints and shades, each feather being a study (Fig. 98). Each one grows from a little sack which holds the quill (*a*). Then comes the shaft (*b*) which is horny, grooved, and filled with seeming wood pith. From the sides of this spring barbs, all of which unite or join to form a flat surface when the bird attempts to fly, in which we may

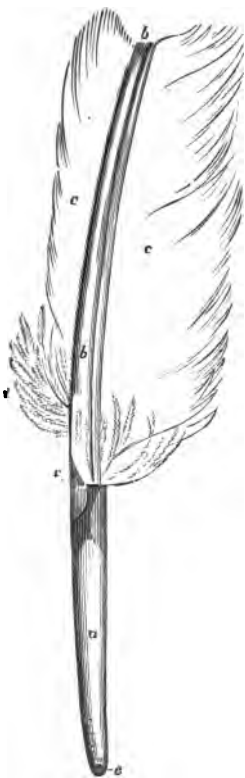


FIG. 98. — A FEATHER.

a, quill ; *b*, shaft ; *c*, vane ;
d, down.

observe one of the most wonderful appliances of nature. Each barb has numerous little barbules (Fig. 99), which hook into those on the opposite barb.

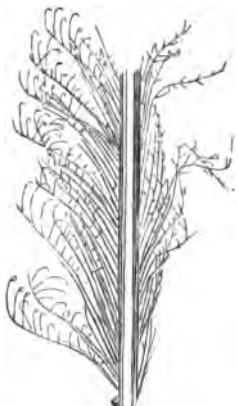


FIG. 99. — BARB FROM A GOOSE QUILL.

Showing the hooklets highly magnified.

In some birds there are no barbules, and the feathers are called plumes, as those of the ostrich. This wonderful coat of feathers sheds water, being provided with oil which the bird takes from a gland near the tail. When birds are seen "preening," they are often oiling their feathers, which thus become a water-tight roof to protect the sensitive body.

It is not necessary for birds to have food prepared for them, as their digestive apparatus (Fig. 100) accomplishes this work. Food, as seeds, is eaten whole and passes into a crop (*c*), and from here into the true stomach, then reaches the gizzard (*g*), where it is ground up as thoroughly as though teeth had been employed. Many birds aid in this by swallowing pebbles and sand. The birds are warm-blooded animals. Their hearts are four-chambered. They breathe by taking in air at the nostrils.

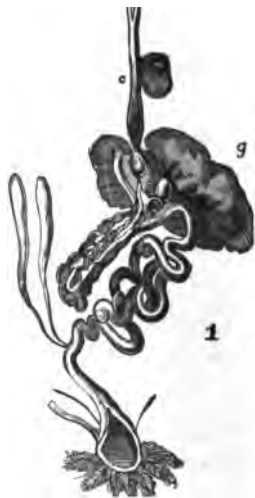


FIG. 100.

DIGESTIVE APPARATUS OF A BIRD: *c*, crop; *g*, gizzard; illustrating passage of food from the mouth.

The lungs are two in number. The latter are filled with large air passages which lead to air sacs, and these in turn connect with the bones, so that the bird can literally inflate itself like a balloon. The air passes down the trachea, enters the lungs, and there aerates the blood, then passing into the air sacs to lighten the bird in its flight. In this manner the bird is enabled to change its specific gravity at will. There are nine of these balloons or air sacs in almost every bird: two in the abdomen, four in the thorax, and three near the lucky bone. The brain of birds (Fig. 101) is larger than that of reptiles, and it has none of the convolutions which we shall observe in the mammals.



FIG. 101.

1, brain of a bird; 2, eye, showing nictitating membrane.

The eyes of birds are wonderful organs. Vultures and hawks have remarkable vision. The eye of the owl is so keen that it can distinguish small objects at night, while the eagles can stare at the blinding sun without winking. No more striking object can be imagined than the eye of some birds. All possess a third eyelid, and many have a ring of hard plates by which they can adjust their vision to objects near or far.

The birds increase by eggs (Fig. 102), which are hatched either by the male, female, or both, or by the heat of the sun. More or less elaborate nests are built for the young. Some of these are in trees; others are in or on the ground; sometimes the eggs are even buried in the sand. As a rule the young are very helpless at first, as in the case of chickens; but the young of the maleo are able at once to

take care of themselves, and can almost fly at the moment they are hatched.

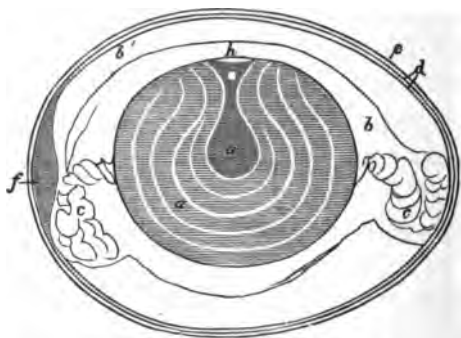


FIG. 102. — LONGITUDINAL SECTION OF HEN'S EGG BEFORE INCUBATION.

a, yolk, showing concentric layers; *a'*, its semi-fluid center, consisting of a white granular substance—the whole yolk is inclosed in the vitelline membrane; *b*, inner dense part of the albumen; *b'*, outer, thinner part; *c*, the chalazæ, or albumen, twisted by the revolutions of the yolk; *d*, double shell-membrane, split at the large end to form the chamber, *f*; *e*, the shell; *h*, the white spot, or cicatrix.

In all, about seven hundred species of birds are known in America north of Mexico; and throughout the world over eight thousand species have been recorded.

ANCIENT BIRDS

There is no more fascinating pastime for young or old than the study of fossil or extinct animals. Almost every section of the country produces certain rocks which ages ago were the shores or beds of streams or the bottoms of oceans, now hardened into rock, yet bearing the impression upon their surfaces of the footprints of every animal that walked or crawled over them, preserving the shells

of living things that formed a portion of the animate world at the time. The accompanying slab (Fig. 103) well illustrates this, as here is a section of a mud flat which formed a part of a shore untold ages ago. Even the sun



FIG. 103.—FOSSIL FOOTPRINTS.

cracks are seen, and among them the footprints of some huge froglike creature that wandered along in search of food.

The rocks of yesterday, then, are the records of the time, and the geologist unfolds and reads them like a book. It would not be surprising if birds were found pre-

served in this way, and within a few years some remarkable discoveries have been made showing that the birds of former ages differed very much from those of to-day and resembled the reptiles. One of the most interesting (Fig. 104) is called the *archæopteryx*, its remains being found in the oölitic rocks of Germany. The bird died, fell upon the muddy flats of some lagoon perhaps, and was covered by layer after layer of mud which in time hard-

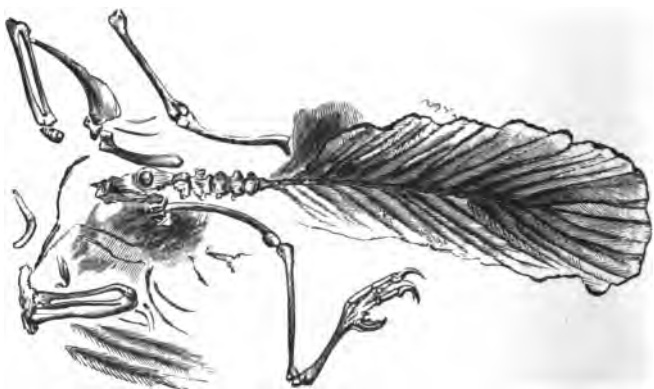


FIG. 104. — ARCHÆOPTERYX.

Tail and detached bones.

ened, preserving the bones so perfectly that experts have little difficulty in making a picture of the bird or a restoration showing it exactly as it appeared in life. It was a most remarkable creature, differing from all living birds by possessing on the wing two free claws by which it could cling to trees or rocks. The most extraordinary feature was the tail, which was like that of a lizard, made up of about twenty-one vertebræ; in other words, it was long, like that of the anolis. Each bone supported a pair

of quill feathers, so that the tail resembled a huge feather, and was in reality the rudder of this strange living craft, the oldest form of the bird known. This singular creature



FIG. 105. — SKELETON OF *Hesperornis regalis*, RESTORED. (After Marsh.)

A bird with teeth. About one tenth of the natural size.

had teeth like those of a reptile, and preyed upon small animals.

Western North America many years ago possessed strange birds with teeth (Fig. 105). The hesperornis was

a gigantic diver as tall as a boy of ten years of age, or about five feet. Its wings were small and useless, showing that it was a diver and swimmer. The tail was shorter than in the long-tailed archæopterix, and the jaws were armed with sharp teeth set in sockets. These strange



FIG. 106. — RESTORATION OF *Gastornis edwardsii*. (After Meunier.)

creatures preyed upon the countless fishes in the shallow seas, whose remains are also preserved, and were among the most remarkable forms of a literal age of wonders. The ostrich is considered a giant bird to-day, but it is a dwarf in comparison with some of the strange birds of yesterday.

In the Eocene of Paris has been found a bird called *gastornis*, which attained a height of ten feet, its colossal size being well shown when compared with that of a man (Fig. 106). It was a link between the waders and the ostriches. The largest and heaviest of the birds have

been found in New Zealand and are supposed to have lived with the early human beings of that country of strange inhabitants. The bones of the moa, as the bird is called, have been found beneath old camps, showing that they had been charred, and it is mentioned in the native legends.

The remains of the moa (Fig. 107) were found in what is known as the Quaternary period, and their discovery created great excitement in the world of bird lovers.

The very first accounts of the birds were related by the natives, and finally, in clearing out an ancient swamp, some bones were found which proved that feathered giants

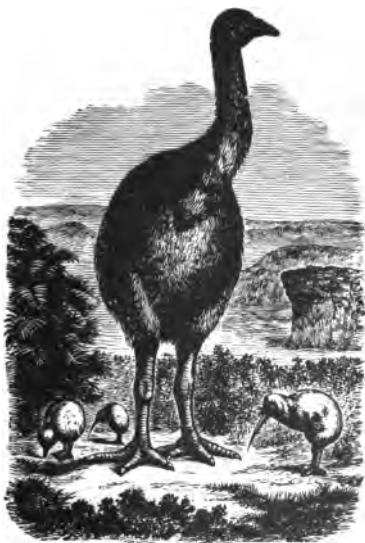


FIG. 107. — WINGLESS BIRDS OF NEW ZEALAND: THE GIANT MOA (*Palapteryx*) AND THE TINY APTERYX.

The moa is no longer to be found alive.



FIG. 108. — *Dinornis giganteus*, $\times \frac{1}{10}$.

From a photograph of a skeleton in Christchurch Museum, New Zealand.

had indeed lived there not so very long before. The dinornis, as one was called, was twelve feet in height (Fig. 108), and its colossal

"drum stick," which was five feet long, was as ponderous as the thigh bone of a large horse.

In Madagascar another huge bird, the *epinornis*, has been found. Its egg was six times the size of an ostrich egg, hence one would have been a burden for a strong man and could have afforded a meal for twenty or thirty men. These giants became extinct but a few years ago, comparatively speaking — a fact proved by the discovery of the feet with the dried skin still clinging to them and huge eggs with the gigantic chick still in them. Many rumors have been circulated to the effect that these birds still live in Madagascar, and several expeditions have gone in search of them, but the eggs alone have been found to tell the story.

LIVING GIANTS

The days of giant birds have not passed. In Africa, and now successfully introduced into America, lives the largest existing bird, the ostrich (Fig. 109), one of the most interesting animals. Tall, powerful, fleet of limb, beautifully adorned with plumes, the ostrich stands as an example of the largest living bird. It lives near the edges of the desert, and is so fleet of foot that it can be caught only by natives who run it down on horseback.

When seen in confinement the ostrich presents an absurd appearance. Its huge body, balanced on long legs, conveys the impression of a very clumsy animal, while the walk, a tilting, teetering, mincing gait, but adds to this impression. The neck is long, the eyes are large, with a peculiarly guileless and innocent staring expression. The

head is extremely small in proportion to the size of the bird, and when fully raised stands eight or even nine feet from the ground. This may be considered the greatest height the bird attains. Indeed, it is vastly different from the robin or the birds that fly. Its bones are colossal, filled with marrow instead of air. It has no keel for the

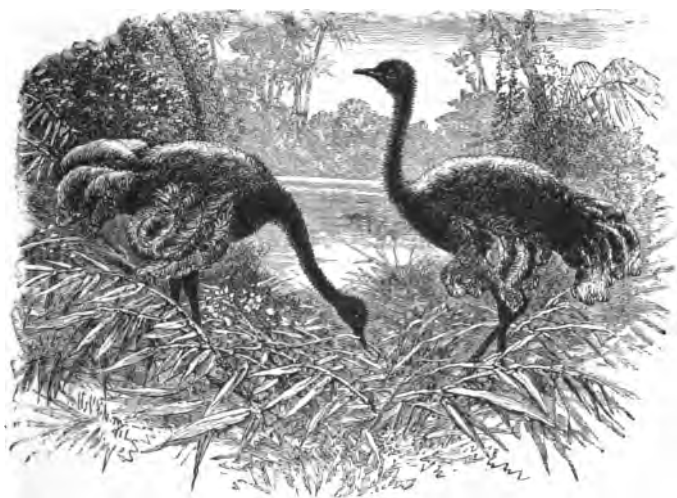


FIG. 109. — OSTRICHES.

wing muscles, as the wings are not used for flight, but merely as sails when it runs, or to toss dust and gravel over itself.

The ostrich has a peculiar foot, bearing but two toes, one longer than the other, and a sharp claw. This is its chief weapon, and I have seen a large bird strike so fiercely that it almost crushed a heavy board fence, and such blows have more than once been fatal to natives. The

blow is given forward, and is a front strike, the reverse of that of a horse, and having a downward tendency is a cut as well, often disemboweling the enemy. The bird can also strike a powerful blow with its beak. It has a most remarkable appetite.

Within a rifle shot of my home in Southern California there are over one hundred ostriches of all ages, of African parentage, and the ostrich farm has taken its place among the important industries of the State. The birds are fed upon alfalfa grass and vegetables, and have an especial fondness for oranges, which they swallow whole, the large fruit being seen passing down the long and narrow throat. I have seen an ostrich feeding from a plank platform about which scores of English sparrows were crowding. When the food was exhausted, the ostrich began picking up the sparrows, swallowing them, feathers and all, half a dozen disappearing in this way before the birds noticed that their numbers were being depleted, so cleverly did the giant pick them up. At the Pasadena ostrich farm, the birds have been known to swallow many kinds of objects from screws to pocket knives, while one bird snatched a lighted pipe from the hand of a man and swallowed it.

The speed of the ostrich is proverbial. Only a fast horse can overtake it, the bird covering thirty miles an hour when hard pressed. The eggs are large, weighing about three pounds apiece. The nest is a mere depression in the sand in which about thirty eggs are deposited. During the day in their native wilds the sun heats them, but in Southern California, where the heat is not tropical, the birds sit, the male and female taking turns; the female, sitting during the day, being relieved by the male at night.

The voice of the male is so resonant, so like the roar of a lion, that it is heard over a mile distant. The young ostriches or chicks soon after hatching are comical objects, apparently covered with bristles. They are carefully cared for by the mother, being fed at first upon the spoiled eggs if there are any.

The ostrich is one of the most valuable of birds. The plumes are the feathers of the wing or tail which are not connected by the little barbules referred to, so are loose or fluffy. The plumes are made up into various articles for wear, and are the only feathers that should be worn, for their use does not necessitate the destruction of the bird, as in the case of others, the plumes being merely pulled out or carefully cut off about the time they are ripe or ready to be shed. At such times the bird is driven with others into a narrow pen; its head is covered with a bag so that it will not kick, and the plumes are removed with the greatest care.

The strength of an ostrich can be compared only to that of a horse. In Southern California two birds have been harnessed to a buggy driven by two men, while a single bird carried a full-grown man upon its back with perfect ease.

The ostrich is represented in America by the rhea or South American ostrich (Fig. 110), a much smaller bird found in the great Pampas districts. It is about three and a half feet in height, and has three toes instead of two. The head and neck are covered with downy feathers, there being none on the tail as in the true ostrich. Many of its habits are similar to those of the true ostrich, and it has the remarkable faculty of swimming rivers when chased.

A large and singular bird, the emu (Fig. 111), is found in Australia, where it is hunted by the natives, also by the wild dogs. It is jet-black, the feathers resembling wiry hairs made of whalebone. Its body is almost as large as that of the ostrich, but its legs are shorter, so that the bird is not over seven feet high. It also has three toes upon

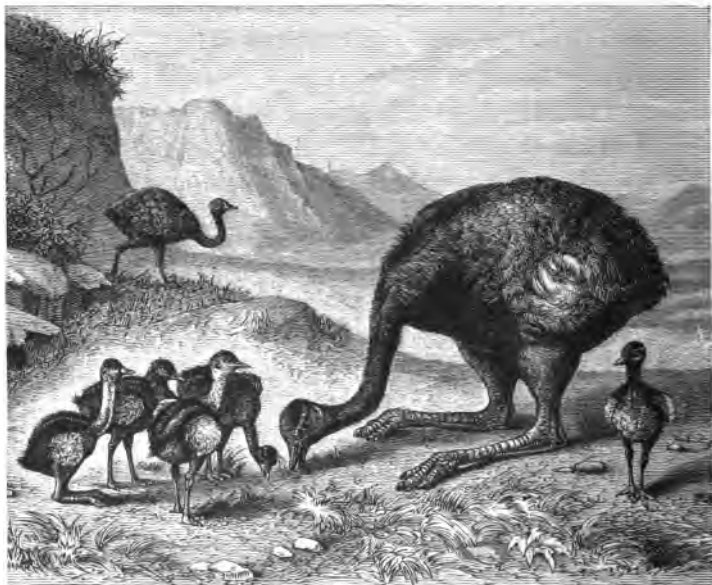


FIG. 110.—RHEA AND YOUNG.

each foot. The wings are rudimentary or useless in flight; yet the bird has been observed trying to place its head beneath them, a habit which holds possibly with all birds having large wings.

Attaining a height of five feet, is the cassowary, a large, powerful ostrichlike bird of the island of Ceram and others of the East Indian archipelago. Its feathers are hairlike

and black, the wing being represented by a long series of fine cylindrical shafts with which the bird when enraged can strike a heavy blow. The head of the cassowary



FIG. III.—EMU.

appears to be ornamented by a crown, in reality a large horny helmet. The eggs, which are valued by collectors, are large and of a green grayish color.

Allied to these birds is one of the most peculiar of the entire tribe, the little apteryx (Fig. 112), a nocturnal or night-wandering creature, found in New Zealand, and most unbirdlike in general appearance. In some respects it resembles a pelican; but it is covered with a thick growth of hairlike feathers, and has small, useless wings entirely



FIG. 112.—APTERYX.

hidden by them. It has no tail; its legs are short and powerful. Its bill is long and snipelike, and at its extremity are the nostrils. It hides by day, wandering forth at night in search of insects, which constitute its food. Its nest is placed in a burrow in the ground, where a single egg is laid. While the apteryx is very shy, it is very helpless, and is doubtless doomed to early extinction, as are all

the large and conspicuous birds upon which a value is placed by man. The ostrich would doubtless long ago have disappeared, had not the ostrich farm been founded for its preservation, as it was the custom of natives in the early times to kill the birds in their attempts to capture them for the feathers.

IN A PENGUIN ROOKERY

When the first navigators visited the Antarctic regions, they reported seeing at various points armed and uniformed men, who sometimes stood at rest, and again appeared to be moving in rank and file. Later exploration showed that the inhospitable regions about the South Pole were uninhabited, and that the supposed soldiers were penguins.

The penguins are very fishlike in their appearance and habits. They are more at home in the water than on land, and when plunging from wave to wave are easily mistaken for fishes or porpoises. When standing on the rocks, they resemble statues. The beak is pointed upward (Fig. 113), giving the bird a laughable and supercilious air. The feathers are very fine, like scales. The wings resemble the fins of the albacore, are entirely useless in flying, and are employed as fins to aid the webbed feet in forcing them through the water with remarkable velocity.



FIG. 113. — PENGUIN.

The king penguin, the largest, stands three and a half feet in height, and from a distance appears to be dressed in a black coat and white vest. The back is dark; the breast is white. The face, as well as the wings, is dark, two narrow bands of bright yellow in front giving it a singular appearance. The bird lives in what are literally bird cities on the various islands of the Antarctic region; and their houses are among the wonders of bird creation. The rookeries are localities selected by the birds near the sea, and are generally divided into two regions with distinct boundaries. In one, the old birds stand erect, by hundreds and thousands, with bills pointed upward; in the other the young, living in what is to all intents and purposes the nursery. There is no nest, the penguin carrying the green and white egg in a pouch between its legs for seven weeks, when the young appears. When carrying the egg, the penguins hop along the rocks, hence acquiring the name "rock hopper." When not bearing the egg they walk as do other birds.

One of the most remarkable rookeries is that of the rock-hopper penguin (*Eudyptes*) found on the island of Tristan da Cunha. It is smaller than the first mentioned, and has a feather tuft on each side of the head, of a brilliant sulphur-yellow, which resembles a quill pen thrust behind the ear. The wings are finlike, and used as such in the water, where the bird, so far as its habits are concerned, is virtually a fish. The rookery here is densely overgrown with a stout tussock grass which bears some resemblance to standing corn growing in clumps higher than a man's head. This vast tract is the home of thousands of penguins, which are attractive creatures with red bills.

Various roads or paths lead down from the rookery or city, up and down which the birds are continually passing and repassing, plunging off into the water to swim head first after the fashion of fishes. The rookery is a maze of streets, alleys, and byways, confusing to man or beast. Once in this strange city of birds, the view is entirely cut off by the high grass; the heat is intense, and the odor almost unbearable; while the nests are placed so thickly along the roadway that it is difficult to avoid stepping upon them and the eggs. On each nest sits a bird screaming, "caa, caa, caa, urr, urr, urr," and driving its sharp beak into the flesh of the passer-by. So resolute are the attacks of the myriads of birds that officers of the *Challenger* who tried to pass through the city were obliged to defend themselves with clubs; but where a dozen birds were struck down a hundred sprang forward to the attack. Moseley says:—

"But you make miserably slow progress and, worried to death, at last resort to the expedient of stampeding as far as your breath will carry you. You put down your head and make a rush through the grass, treading on old and young haphazard, and rushing on before they have time to bite. . . . I always adopted the stampede method in the rookeries, but the men usually preferred to have their revenge, and fought their way every foot." The nest of these birds is a mere shallow depression in the mud, lined with grass, in which is laid two greenish white eggs, upon which both male and female sit. The rookery at Inaccessible Island is even larger and more remarkable. The penguins remain there from July to April, then make a singular migration, utterly disappearing, swimming

doubtless to some region farther to the south. The males return in July, the females in August.

THE AUKS AND THEIR FRIENDS

What the penguin is to the Antarctic regions the auk is to the North. It bears a strong resemblance to that singular bird, and is one of the least valuable to man. The auks are particularly interesting from the fact that the giant of the tribe, the great auk (Fig. 114), has become extinct since the discovery of America. Three hundred years ago it was very common, and near Iceland was killed by the boatload; and that it ranged the coast as far south as the coast of Maine is shown by the presence of bones in the shell mounds of that State.



FIG. 114. — GREAT AUK.
Extinct.

The great auk was a fine-looking bird, standing about three feet in height. Its wings were rudimentary and useless, hardly four inches in length. Its beak was sharp and powerful; its back black; its breast was white; while its feet were large and webbed. It laid but a single egg about the size of that of the swan, spotted with small but irregular blotches. So rare is this bird to-day that not over a dozen good specimens are known, and all are valued at from one to two thousand dollars apiece. One

was purchased by the American Museum of Natural History a few years ago at a cost of six hundred and fifty dollars. The eggs are equally rare, and each specimen of bird and egg is as well known as any one of the rare and beautiful diamonds of the world.



FIG. 115. — RAZORBILL AUK.

tet, tet, tet," is often heard. Another beautiful bird is the razorbill auk (Fig. 115), which has a peculiar bill crossed by white bands.

Nowhere is bird life so well represented as in certain regions on the borders of the Arctic Ocean. There the lofty cliffs are often covered with sea birds of all kinds, most of them

famous divers, as the auks, puffins, and others. The guillemots are attractive forms (Fig. 116). I have often



FIG. 116. — GUILLEMOT.

had single specimens play about my boat when fishing, and have seen them flying under water using their

powerful wings as they do in the air. The murre (Fig. 117) is a beautiful bird, the head of graceful shape, calling to mind some of the terns. Among the myr-

iads of sea birds we shall find the puffins (Fig. 118). The tufted puffin has a singular crest of yellow, silken feathers above the eyes, which gives it a peculiar jaunty appearance. The common puffin, or sea parrot, forms a burrow for its nest, in which the single egg is placed. This tun-



FIG. 117. — MURRE.

nel is often taken by a rabbit that insists upon bringing up its family in the same den.

Among the most skillful divers are the loons (Fig. 119), which have been caught on lines thirty or forty feet from

the surface in the Great Lakes, where this remarkable bird can swim a quarter of a mile without coming to the sur-



FIG. 118. — PUFFIN.

face. There are but five species, all richly marked, standing upright much after the fashion of the penguin, the legs being placed at the extreme end of the body. The adult specimens have a dark back with regular blockings of white. In the winter they come south and are found in the temperate regions; but in summer they migrate to the Arctic zone, where they nest and breed. In diving they use the powerfully webbed feet alone, and so rapidly do they swim that few fishes escape them. The red-throated loon and the black-throated loon are well known. No more graceful birds in the water can be imagined. On the Pacific coast I have watched them following up schools of small fry, dashing in among them with great rapidity, and rarely failing to secure their prey. I have seen three loons so demoralize a school of fishes that they formed an almost solid ball and remained perfectly stationary while the loons dashed into them, at the same time so encircling the mass as to prevent their escape.

In this work of destruction they were soon aided by several cormorants, and later by a seal.

Among the really beautiful birds of the sea are the grebes (Fig. 120), common in many countries. The foot



FIG. 119. — LOON.

of the grebe differs much from that of other swimming birds, having lobes upon three of the toes, but not uniting



FIG. 120. — GREBE.

cunning, often coming to the surface with only the tip of the bill exposed, thus giving the impression that they remain below for an indefinite period. A little grebe kept at Santa Catalina was almost helpless on land; making scarcely any effort to fly, but once in the water it was a type of activity. The nest of the crested grebe is formed of rushes, and is a veritable floating island, upon which

them as in the duck, where the web connects the toes. The western grebe and the pied-billed grebe (Fig. 121) are attractive forms, the heads especially being beautiful and jaunty. The grebes are famous swimmers and are very



FIG. 121. — PIED-BILLED GREBE.

the eggs, from two to seven, are laid. The nest of the Castanean grebe, according to a French naturalist, is

paddled about by the bird, which sits upon it with one foot overboard at such times. These birds are all valuable for their rich feathers, which are used as furs and trimming.

SOME OCEAN FLYERS

PETRELS AND GULLS

Among the grebes and sea birds there are many others with long, graceful, pointed wings—the gulls and their allies. These are among the most attractive of birds; not for their colors, as they are almost always gray, white, or black, but the contrasts of tint are so marked, and their flight is so well sustained that they are famous the world over.



FIG. 122. — LAUGHING GULL.

On the Florida reef the laughing gull (Fig. 122) is a very common form, its victorious “ha ha” being heard at all times. Its black head and lighter body are conspicuous objects far away. It follows the patient pelicans about the reef, and when the latter secure a catch, drops down upon them, alighting on head or back, and snatches the fish from the very mouths of the stupid peli-

cans just as they are prepared to swallow it. The laughing gull then rises and utters the loud "ha ha, ha ha." Often this cry is immediately interpreted by the man-of-war bird, which comes plunging down from the empyrean, where it has been soaring, to begin a contest in the air that fully demonstrates the marvelous power of flight possessed by these two birds. Higher they climb until almost out of sight; then they come plunging downward, living arrows, the larger bird invariably forcing the gull



FIG. 123. — SABINE'S GULL.

to give up its prey, which the swift man-of-war bird catches before it touches the water.

At Santa Catalina Island the gulls follow the steamer to Avalon and back, nearly sixty miles, every day. Some rest a

few moments on the gilt ball at the topmast, but nearly all fly the entire distance and are often fed by the passengers, who toss bread and crackers at them, which are sometimes caught in the air. The ivory gull is a beautiful creature, pure white, and found in the far North. Its bill is yellow and its feet are black. The American herring gull is also white, with the tips of the wings dark, while Sabine's gull is a rare and graceful form (Fig. 123).

These gulls and their allies are of great value to man. All along shore they are the scavengers, eating dead

fish and other objects which drift ashore, and in almost all localities they are protected from the vandals who would shoot them for the skins. Of all the tribe, the albatross (Fig. 124) is the most remarkable flyer, being rarely if ever seen near land, except when it breeds. It has earned a reputation for long journeys which, while perhaps somewhat exaggerated, exceed that of any other bird. These birds are usually met with in the southern seas, being rarely seen in the United States. Several, however, have been observed at Santa Catalina, California, and in Florida. The albatross looks like a gigantic gull. The male bird is snow-white except the tail, which is dark; the females are sprinkled with



FIG. 124. — ALBATROSS.

gray. These birds nest at Marion Island among other places and dot the plains, their great white bodies being conspicuous objects. The nests are made of moss or grass raised from the ground about a foot; they are conical, with broad bases and much earth packed and beaten in, so that when the birds are not on the nest the latter resembles a seat. The egg is not laid in the nest, but is held in a pouch by the female. It is nearly five inches long, white, speckled with red at the larger

end. When the female is on the nest, the male stands or sits beside her. At this time they will not rise when approached, but merely snap their bills. The male is very devoted and evidently tries to amuse his mate. Professor Moseley suggests that he is singing to her. In any event, he stands close beside her, raises his wings, spreads his tail, tosses his head in the air, and all the time sways his neck up and down, uttering a curious cry. His mate responds in a similar strain. Then they press their beaks together, repeating this laughable performance by the half-hour. These birds followed the ship *Challenger* for five hundred miles south of Heard Island, but left her when two hundred miles from the Antarctic barrier.

Some of the large gull-like birds, as the Antarctic skua, are fierce and dangerous creatures, preying upon other birds of all kinds. The naturalists of the *Challenger* were obliged to beat them off at times, and when shooting other birds it was often necessary to shoot a skua before it carried off the game. The penguin cities are favorite nesting places for these fierce birds, their nests



FIG. 125. — NORTHERN SKUA.

being surrounded with piles of bones, suggestive of their cannibalistic habits. There is a northern skua (Fig. 125), a large, powerful bird, which attacks other birds, sucks the eggs of ducks and various sea birds. The mollymauk,

a smaller albatross, builds a columnar nest more than a foot in height and fourteen inches across. Its egg is also held in a pouch.

Closely allied to the gulls are the terns. These are graceful, swallowlike creatures, long and delicate of limb, types of all that is beautiful or graceful on the wing. They are found with the gulls, but rarely venture far from shore. When flying, they hold the bill pointed downward, as though carefully scanning the water. If a fish appears, they plunge after it like a kingfisher. In a word, the tern is a hunter, while the big and clumsy gull is more of a scavenger. I once kept a sooty tern (Fig. 126) as a pet, the dainty little creature soon learning to eat from my hand. All the terns are beautiful.



FIG. 126. — SOOTY TERN.

One of the most remarkable sights I have witnessed was at Bird Key on the Florida reef, where many thousands of terns similar to Figure 126 congregate to lay. The terns laid their speckled eggs upon the sand without any semblance of a nest except a slight depression. Upon my first visit to the island it was almost impossible to walk without crushing them. Almost every foot or yard was preempted, and we collected them in flour barrels, placing a layer of leaves of the bay cedar and then a layer of eggs, and found them excellent. When I landed, the terns rose

in a body uttering discordant cries in such volume that it was a babel worse confounded, and to make my companion by my side hear, it was necessary to scream. This had a singular effect upon the birds, as no sooner did they hear the unusual sound, than every bird ceased crying, a perfect silence ensuing for two or three seconds, then the crash and turmoil caused by thousands of voices again broke the stillness. This would be repeated indefinitely. Among these terns were many noddies, dark brown birds with white crowns. They built a rude nest of twigs in the bay cedars, upon which they laid an egg almost as large as that of a hen and almost white, while the egg of the tern was blotched. When the young noddy appeared, hatched out partly by the terrific sun, the mother brought it fish, which it fought for with throngs of marauding crabs.

How the mothers of these unnumbered thousands found their own young was a mystery, as in crawling through the hot stifling bush the young would rush away, exchange positions a score of times, and were so plentiful that I could pick up a dozen without moving. Yet I never saw a dead bird; each one was fed by some one of the cloud of terns which hovered over the green-crested key. So great was the number of birds that from a distance of a mile they appeared like a cloud hanging over the island, and half a mile distant I could hear the distinct and rasping roar of their cries. When they were not disturbed, very few were seen. Every year this vast concourse gathered on this island and East Key, and on no others, though there were six or seven keys. They gathered from far and near, flying perhaps hundreds of miles to find the particular spot upon which they were born. How

they found this key of but fifteen acres, over a wide waste of waters, it would be difficult to explain.

Still another interesting bird of this type is the skimmer (Fig. 127), whose bills are like knife blades. To obtain its food it skims along the water, with its lower jaw just



FIG. 127. — SKIMMER.

under the surface, thus picking up various small fry. I have watched these beautiful birds on the outlying islands of Texas, and wondered at their inexhaustible fund of patience. Those who go down to the sea in ships, and many who do not, are familiar with the graceful Mother Carey's chicken, or stormy petrel (Fig. 128). As soon as a ship gets well out from land, these little voyagers join her and follow in her wake for hundreds of miles, a never ceasing entertainment to passengers and crew.



FIG. 128. — STORMY PETREL.

The latter have an especial regard for them, amounting in some instances to a superstition that ill will befall the ship that permits a petrel to be caught. I well remember the indignation

of an old quartermaster when I caught one by tying a piece of meat to a cord. I wished to see the living bird, and released it unharmed; but the old sailor predicted a storm as a result of the deed. This little bird could not fly



FIG. 129. — SHEARWATER.

from the deck, and only regained its freedom when I tossed it into the air. They spend the greater portion of their time at sea, following vessels for the food thrown over, resting upon the water. At Kerguelen's Land the

petrels nest on the ground, forming long tunnels six inches in diameter at the end of which is a small room where the nest is built. The giant petrels prey upon gulls, and certain ones are famous divers.

The shearwaters (Fig. 129) are handsome birds. At Tristan da Cuna they honeycomb the soil with their burrows. In certain parts of Europe they deposit their



FIG. 130. — TROPIC BIRD.

eggs in rabbit burrows. Resembling them is the fulmar, often the attendant of fishermen, following their boats.

Among the really beautiful sea birds is the yellow-billed tropic bird (Fig. 130), with its long tail and graceful flight.

Those who have visited Florida will recall the very stupid and ungainly bird called the booby which permits the man with the gun to approach it so closely that it can almost be touched. An allied form is the gannet, which bears some resem-



FIG. 131. — SNAKE BIRD.



FIG. 132. — CORMORANT.

blance to a goose, and possesses the latter's stupidity. In the swampy regions of Florida is found the snake bird, or water turkey (Fig. 131), its long and slender neck suggesting a snake. It is a dangerous creature, the bird invariably striking a vicious blow at the face when wounded or resisting capture.

Near relatives, and resembling them, are the cormorants (Fig. 132). They have long necks, stout bodies, and hooked

bills. They stand erect, supported by the stiff tail. They are among the most remarkable of all swimmers, chasing sardines, anchovies, and other small fry with such speed that they are a factor to be considered. Two or three species are common off the islands of the California coast, and I have climbed to their nests on Santa Cruz Island. They nest in almost inaccessible localities on the face of cliffs, the nests, which are made of seaweed, in the case of Brandt's cormorant, being filthy in the extreme. Many of the young die by falling into the surf before they are large enough to swim. At San Nicolas Island I saw a vast flock which gathered every morning. The birds began to arrive at about eight, coming in small bands of a dozen or more, and all alighting in a flock in smooth water near shore. Suddenly all headed in a given direction and swam in. Then, as though ordered, they turned, gabbling and uttering the strangest sounds. No one could witness this performance and not be impressed with the belief that it was a bird convention of some kind.

All these cormorants had certain resting places at Catalina, at the north end of the island, on Ship Rock. In the morning they flew away to feed, going twenty miles. They returned at night, the long lines of "shags" appearing like some gigantic sea serpent winding its way over the ocean. I have watched them feeding, darting into schools of small fry, dashing along the bottom twenty feet deep with marvelous speed, easily capturing the agile fishes, and have often hooked them when fishing at this island, in winter when they are very tame. In China the cormorants are trained to fish for their owners, who place about their necks a band of leather sufficiently tight to prevent

them from swallowing the fish; then they are released, the birds bringing their catches to the surface, for which they are rewarded.

THE PELICANS AND DUCKS

The boobies, the cormorants, and the gannets have cousins in the pelicans — the long-beaked, pouched creatures of solemn mien, found in almost all tropical regions.

In Florida the brown pelican (Fig. 133) is the common form.

On land it is very clumsy, its short legs being poorly adapted for locomotion, yet with their wide webs excellent paddles.

The pelican has an extraordinary pouch beneath the lower jaw, which is really a huge dip net, to aid the clumsy bird in the capture of food. Although a large bird, it is extremely light

in the air, on account of the presence of air sacs under the skin. It is particularly buoyant

on the surface of the water, which is the position of its choice.

The birds move in flocks, paddling slowly along with bills lying close to their breasts, giving them a very dignified appearance. At such times the birds are resting, but when hungry they rise and fly with heavy beating of the wings forty or fifty feet above the water, eagerly scanning the surface. When a school



FIG. 133. — BROWN PELICAN.

of fish is observed, the pelican turns and plunges down, head first, like a catapult, opening the mouth wide just before it reaches the water. As the fishes can not see upward, it engulfs scores in its capacious pouch, out of which the water drains, leaving the fishes, which are afterward swallowed with an upward, tossing motion of the head.

I found the pelicans nesting in mangrove trees on Bush Key. The nests were the rudest piles of brush imaginable, on the top of which the eggs were placed. The young were strange creatures, and not particularly agreeable neighbors, with their insistent, asthmatic voices. I kept several as pets. They followed the boat over the reef, alighted on it at times, and roosted on the side of a fisherman's hut when ashore. The fisherman, by fastening a strap about their necks, obliged the patient birds to fish for him.

On the upper Florida reef the pelicans nest in vast numbers, and hundreds may be seen standing on the partly submerged sand banks, resting after their fishing excursions. Their flight is particularly graceful after getting "under way." They come down within a few inches of the water and move a long distance without any motion of the wings—the perfection of soaring; and when the momentum is exhausted, they rise to plunge down again. I have seen my pet pelicans soaring in this manner not five feet from my boat, where it was plain that no motion was made. In California the brown pelican has a similar habit; but in diving, it often disappears entirely from sight for a few seconds. The appearance of these graceful birds along the shore at Santa Catalina and San Pedro formerly added much to the attractiveness of the locality, as the

birds were exceedingly tame; but an order came from a Chicago milliner for pelican skins, and the birds were shot down by the boat load. A law was finally passed making the killing of these birds and of gulls a penal offense, and so they were saved. Every reader of these lines should see that the birds of his locality are protected, as there is a price upon the head of almost every bird, which can only result in their extinction.

I visited an interesting pelican rookery at Anacapa Island, opposite Santa Barbara, and found a lofty, sloping mesa on the south side of the island covered with birds, which rose in the air in a vast cloud as we approached. The nests were all upon the ground. One of the most interesting of this group is the white pelican, a large, finely formed bird, pure white except the primary feathers. These do not dive for their prey, but swim along the surface, striking at it with their powerful bills. The white pelican is an inland species as a rule, found in Nevada, Utah, and many inland States. During the breeding season both sexes develop a peculiar, horny crest upon the beak, which is afterward cast off. A naturalist visited a nesting place of these birds in Nevada, and in the nesting month found the ground strewn with the rejected crests. In Santa Barbara a fisherman has a pet white pelican which he caught several years ago. At the breeding season this fine bird disappears, going perhaps hundreds of miles to join its mate and then returning to the back yard of Larco. Year after year the bird has returned, being perfectly tame, playing with boys, dogs, and cats. The pelicans have no enemies except the laughing gulls, which, as we have seen, systematically rob them.

Closely related to the pelicans is the man-of-war hawk (Fig. 134), which in my estimation is one of the most grace-



FIG. 134. — MAN-OF-WAR HAWK.

ful of all flyers. There are but two species, found mainly in semi-tropic waters. They are lithe and powerful, with an enormous spread of wings. The tail is forked and black in color. The legs are weak and small; the beak strong and

pointed. The bird, being virtually a hawk in appearance and a thief by habit, robs the gulls and other birds.

Few if any birds have a greater power of flight. I have seen them lying almost motionless in the air six hundred feet above Garden Key, Florida, during the heaviest gales. The birds faced the wind, their broad wings extended and immovable even when examined through a glass. They were seemingly tilting on the wind, retaining their position for hours, or as long as the gale lasted, enjoying the commotion of the elements that had driven every other bird to cover. I have watched them off the islands of Texas, where their girations could not fail to arouse admiration. They nest among the mangroves of the low-lying islands or keys in the tropics, and when not hunting for game or soaring high in air, roost in the low trees. But does the victorious cry of the laughing gull announce that it has robbed a patient pelican, the great man-of-war bird rises, and in a few seconds is in vigorous pursuit, affording me on many occasions a mar-

velous exhibition of the possibilities of flight and activity in mid-air. The eye of the bird is fierce and striking, and beneath the throat is a vivid vermilion patch which gives it a martial and striking appearance. In the Ascension Islands it builds its nest in the guano beds, while those



FIG. 135. — DUCKS.

found at Fernando de Noronha are upon the very edge of steep precipices. The nest contains but a single egg. In the islands of Australia there is a species which forms its nest of twigs in low bushes. The bird has a peculiar musklike odor, which once experienced will not be forgotten.

Among the most familiar of all birds, partly because of their domestication, are the ducks and geese, embracing about two hundred species (Fig. 135). The ducks are essentially surface swimmers and have webbed feet. They

have soft down, beautiful feathers, richly colored, while the beaks are, as a rule, flat bills provided with ridges, or



FIG. 136. — HOODED MERGANSER.

fine serrations, which serve as strainers when feeding. There are fish ducks, river ducks, sea ducks, geese, and swans, all differing materially, but having many features in common. The fish ducks are large, powerful birds, richly colored. They are skillful divers, the hooded merganser (Fig. 136) being particularly attractive. Perhaps the most beautiful duck after the famous mandarin duck of Japan, whose beauties of

feather can not be adequately described, is the American wood duck (Fig. 137), with its marvelous combinations of tint, color, and tone.

The bird builds in holes in the trunks of trees along the edges of streams, and when the young are hatched, carries them down to the water in her bill.

Among the ducks particularly valuable



FIG. 137. — WOOD DUCK.

to man are the blue-winged teal, the green wing, the black duck, the mallard that is domesticated, the red

head, the canvasback, and many others. The eider duck (Fig. 138) is one of the most valuable of the tribe on account of the delicate down it provides to line its nest, this being collected to form pillows and cushions. The river ducks feed upon vegetation of various kinds, which they dive for in the bayous and lagoons along shore, and they are not averse to grain. The fish ducks go to sea and prey upon small fry, while the sea ducks are found in rivers, bays, and the open sea. The waters of Chesapeake Bay are a famous place for the canvasback. I have seen the surface covered for acres with these and other fine game ducks. Few birds are so valuable as the ducks, as from one end of the country to the other the swamp lands are owned by clubs devoted to the sport. These often have expensive club houses, to maintain which thousands of dollars are expended annually. In Los Angeles County, California, almost all the swamp and lagoon land is reserved in this way, and along the Sacramento River thousands of acres are so utilized, giving employment to many persons, while the birds killed are all used as food.



FIG. 138. — EIDER DUCK.

The geese (Fig. 139) are fine, large, handsome birds equally valuable. The snow goose, as its name implies, is

pure white, except the tips of the primaries, the bill and feet being red. The barnacle goose is a well-known bird,



FIG. 139. — WILD GOOSE.

found most plentifully in the Eastern Hemisphere. Our most common form is the Canada goose (Fig. 140). The ducks and geese migrate each year, covering long distances, summering in the far North, often on the shores of the Arctic Ocean, returning south at the beginning

of winter. These migrations, particularly those of the geese, are very interesting in Southern California. The birds follow the Sierra Madre range and make their presence known by loud "honking." The flock is seen to be V-shaped, led by a single bird, and they literally slide downhill either to the north or south.



FIG. 140. — CANADA GOOSE.

I have seen a flock of hundreds not five hundred feet up at the base of the Sierras, evidently in the greatest confusion, but they

rapidly took the form of a great spiral, and in vast whirls went winding upward, rising higher and higher, now disappearing, and then as the sun struck their backs, flashing out like silver dollars against the sky to disappear again. So upward the flock climbed into the empyrean until it attained an altitude of a mile, above or even with the summits of the Sierras. Then the leader turned to the north, and after a few violent flappings of its wings, spread them out and soared away. It was followed by the flock, which lined out with unerring precision. I have watched them as far as the eye could reach, and the wings were not flapped, the geese sliding downhill, moving on with great rapidity for several miles. When they reach a dangerously low altitude, at a signal from the leader in all probability, they break up and for a few seconds seem involved in confusion. Then they rapidly fall into line and begin another ascent, which carries them high into the air again, when another aerial toboggan slide is begun. In this way some geese doubtless move several hundreds of miles in a short time with a minimum amount of exertion.

Of all this group of birds, the swans

(Fig. 141) are the most beautiful. They are types of grace and ease when on the water, seemingly designed to ornament ponds and other artificial bodies of water. Owing to the fact that they are easily domesticated, they are always



FIG. 141. — SWAN.

found in preserves where animal life is desired to intensify the beauties of woodland streams. The swans are so heavy that most of their time is spent on the water, where they feed in the shallows by thrusting their heads below the surface and probing the muddy bottom for animal and vegetable food.

The swan is a graceful and swift swimmer, having broad webs which force it along over the surface like a beautiful barge. The black swan of Australia is an attractive bird, in sharp contrast to its white cousin. I have seen its nest in Central Park, New York, where it is completely domesticated. The period of incubation is about six weeks, the male assisting its mate in the nesting process, taking her place when she goes abroad for food or recreation.

SOME WADING BIRDS

Diving and swimming birds, as we have seen, are adapted by nature to the kind of life that they lead. Among them are many with long legs which enable them to wade along the shallow flats and secure the food of their choice without diving. I well recall the first flamingo I saw, standing with a scarlet ibis on the submerged outer reef, the rich vermilion color making the group a conspicuous feature of the landscape. The two birds stood like statues, each posing in a different position and permitting me to approach so closely that I could easily have brought them down. When they did rise, it was with a heavy, lumbering flight, using the long legs to beat the water, so that they appeared to be walking off into the air.

The legs did not assume the trailing position until they were well above the surface.

The flamingo builds a nest of mud, in very shallow water, from one to three feet in height, on which it sits with legs drawn up. There is a large rookery on one of the Bahama Islands where, in the nesting season, hundreds of the vermilion-tinted birds can be seen appearing from a distance like a pink cloud.

I once kept a flamingo (Fig. 142) as a pet, and its dignified strut and continual posing made it most interesting. It had a singular habit of thrusting its head upside down between its legs, as though to look backward, and took so many odd positions that I should not have been surprised at any time to have found its neck tied in a bowknot.

The flamingo's body is small, its legs and neck are inordinately long, so that the head can be twisted about in a most remarkable fashion. The flamingo is the king of the waders, its stiltlike legs serving it well, as it wanders along the shallow lagoons. Its feet are thoroughly webbed, as complete swimming organs as those of the duck; yet I never saw a flamingo swim, though doubtless they often do so.

A companion of the flamingo is the roseate spoonbill



FIG. 142.—FLAMINGO.

(Fig. 143), a delicate, rose-colored bird, with a bill so broadened at the tip that it resembles a spoon. I have seen



FIG. 143. — ROSEATE SPOONBILL.

them standing on the reef alone or with the ibis (Fig. 144). The latter, especially the scarlet ibis, is a beautiful bird of brilliant plumage and really a native of South America, though common in Florida. The ibis was a sacred bird in Egypt years ago, and its mummy is often found in the ancient tombs. The bird is a familiar object along the Nile or on the Delta. The white ibis is a striking form, found mostly in the interior on land. It has a sharp sicklelike bill and bears so striking a resemblance to a curlew that it is often mistaken for it. The white-faced ibis is still another, while the wood ibis, a large, striking bird (Fig. 145), leads us to the storks, the largest of the wading birds.

These strange birds (Fig. 146) have a wide range, the

them standing on the reef alone or with the ibis (Fig. 144). The latter, especially the scarlet ibis, is a beautiful bird of brilliant plumage and really a native of South America, though common in Florida. The ibis was a sacred bird in Egypt years ago, and its mummy is often found in



FIG. 144. — SCARLET IBIS.



FIG. 145. — WOOD IBIS.

chimneys (Fig. 147), the birds being supposed to bring good luck to such houses and their occupants. The migration of the stork is an interesting spectacle.

One of the most valuable of the storks is the marabou, from which the beautiful feathers of that name are taken. The birds have but a single representative in America, the South American jabiru (Fig. 148). It is a large, powerful bird, with

most interesting being found in Europe and Asia, where in many cities they are protected as are the buzzards in South Carolina, where they perform the duties of valuable scavengers. In Holland it is not unusual to see storks nesting on the tops of



FIG. 146. — STORK.



FIG. 147.—STORKS AND NEST.

scratched its ponderous head. The stork is often kept by planters as a sort of watch dog, sometimes doing valuable service in driving off intruders.

An ally of the stork is the curious adjutant bird, a grotesque figure either sitting or standing. It is easily recognized by the curious pouch-like object under the throat. It stands five feet in height,

an enormous bill, slightly curved upward. The head and neck are bare with the exception of a single patch like a wig at the back of the head. The head and neck are dark and set off by a necktie-like band of vivid red. In South America this bird is often tamed. One with which I was acquainted was extremely docile and would stand silently by my side as I



FIG. 148.—JABIRU.

and when walking slowly along has a most grotesque and dignified appearance, its wan and skinny visage giving it the appearance of a very ancient bird. It is considered a valuable scavenger, having but one bad quality, that of not distinguishing between friend or foe. One has been known to pick up and swallow a kitten and a puppy belonging to its master, not to mention divers young chickens. Indeed, I have heard of an adjutant bird that swallowed a small cat, and there is apparently no limit to its appetite.

The whale-headed stork is another allied form, its beak being so large that it might be easily mistaken for a wooden Dutch shoe.

Twenty years ago one of the charms of Florida was its flocks of cranes and herons. They dotted the sides of rivers and marshes, and were seen in every lagoon and all along the coast. Even in New Jersey their nesting places were discovered, but it was found that their feathers were valuable for decorative purposes, and war was begun against the most beautiful of birds. Hundreds of men went out and shot them by thousands, and the places that knew them once in countless numbers know them no more.



FIG. 149. — WHOOPING CRANE.

One of the most conspicuous of the group is the whooping crane (Fig. 149), found in the Gulf States in winter and far to the north in summer. I have often watched its

migration, large flocks moving along in regular order, their long legs dangling behind. Quite as striking is the sandhill crane, a large, powerful bird of a slate-brown color, famous for its peculiar antics. I once saw a flock in Florida, and by much maneuvering and creeping through the brush, obtained a position within fifty yards of them unobserved. There were possibly twenty or thirty birds standing in an irregular circle, and as I



FIG. 150. — AMERICAN BITTERN.

reached the spot a single bird was leaping up and down, raising its wings and trotting around in a circle, going through a variety of maneuvers. When fatigued it dropped back, and another bird took its place, stepping with mincing gait, jumping into the air, thrusting its head down close to the ground and running in a circle, each bird evidently trying to exceed its predecessor.

These "dances" occur in the spring, and are supposed to be a feature of the courtship of the birds.

The herons appear to be small cranes. They have sharp bills and long legs and are found in meadows and swampy places, where they prey upon small reptiles and fishes. No animal has an eye more fierce or uncompromising than the heron. It is fiery, staring, and totally devoid of expression. The invader may be assured that the sharp bill will be driven full in his face if the oppor-

tunity offers, for these birds, especially when wounded, are extremely dangerous. I have kept several as pets, but always found them treacherous. This is particularly true of the American bittern (Fig. 150), whose peculiar booming notes are often heard a long distance. The bird is very cunning. Upon one occasion I came upon one in a deep glen in the White Mountains and was so near the bird that I could have struck it with a stick. It evidently thought that I did not see it, and pointed its bill directly upward, holding its position as rigid as a limb of the tree. It bore such a close resemblance to one that I should have passed it by had I not accidentally discovered it. As far as I could see in passing, the bird held its position.

One of the most beautiful of the group is the great white heron, which is a conspicuous object on the Florida reefs, where the snowy heron is also seen (Fig. 151). In the breeding season this beautiful heron has fifty or more rich plumes upon its back, which tip upward, giving the bird a jaunty appearance. It also has a white, lacelike crest. This radiant bird, one of which I have kept in confinement, is almost extinct, having been destroyed for its feathers. The American egret also has almost disappeared.



FIG. 151. — SNOWY HERON.

Among these birds the great blue heron is one of the most striking (Fig. 152). I have often taken it on the Florida reef, where it is called the golden heron, and frequently eaten. The prevailing tint is dark steel. It has a graceful crest. Its eye is beautiful but fierce. When wounded, the bird fights with great ferocity, inflicting



FIG. 152. — BLUE HERON.

a severe wound with its sharp bill. All these birds have peculiar powder-down spots on the breast; these are oily, and seem to secrete a yellowish powder. A sportsman informed me that in shooting the black-crowned night heron, or an allied form, the powder-down spot was phosphorescent, emitting a distinct light as the bird stood in the water, so that he fired at the light, killing the bird. As he held it in his hand the light gradually faded, dis-

appearing as the bird died. Several other observers told me similar stories regarding the light on the heron's breast, which they supposed was reflected upon the water, attracting victims to the silent watcher. So far as known, no naturalist or trained observer has seen the light.

The yellow-crowned night heron is a beautiful bird, and solitary in the strictest sense,

One of the most attractive birds I have ever kept in confinement was the Carolina rail, or sora. I often found



FIG. 153. — PURPLE GALLINULE.

them on the outer Florida reef after storms, blown in shore, and so weary that they were easily captured. The eye of this little bird is the antipodes of that of the heron, a beautiful brown, very expressive, mild, and gentle. The little birds are easily domesticated. With them I often caught the Florida gallinule and the purple gallinule (Fig. 153), the latter one of the most attractive of the marsh birds. It is brilliant purple in hue; the back is olive-green, the bill red, and the legs are yellow. The toes are extremely long, and the bird runs over the leaves of the water plants with ease. All these birds run a long distance before taking



FIG. 154. — AMERICAN COOT.

to the wing when chased, and are difficult to capture.

The American coot (Fig. 154) is a common form better

known as the mud hen. It is the familiar of every pond or swamp, having little fear of man, as it is seldom or never shot. Duck hunters are familiar with the peculiar grunting note of the Virginia rail (Fig. 155), and the bird is in great demand by sportsmen. Even more remarkable



FIG. 155. — VIRGINIA RAIL.

are the notes of the limpkin, or crying bird, a large, graceful bird found in Florida, in whose swamps its mournful note is often heard. The rails are rarely seen, as they are very clever in hiding in the brush at the water's edge, and so resemble their surroundings that they often escape observation though directly under the eye.

In walking or riding along any shore, flocks of delicate birds in gray tints and with long legs are ever rising and wheeling away, alighting a little farther along, running quickly and thrusting their long bills down into the sand in search of food. These little birds are the small waders, avocets, sandpipers, and others, all adding materially to the charm along the great Atlantic or Pacific highway of sand and dune. One of the most

interesting localities for them I found at the beach of Amelia Island, northern Florida. This is a wide, hard stretch of sand, upon which it was my custom to ride, and as my horse ran along the sands, countless



FIG. 156. — BLACK-BELLIED PLOVER.



FIG. 157. — WILSON'S SNIPE.

air, as they whirled along. Among them was the plover (Fig. 156), the valued golden plover, the killdeer, with its shrill "*kill-dee*," often repeated, the piping plover, singing "*peep-peep*," and many others, all possessing special attractions. Among them was Wilson's snipe (Fig. 157), the long-

hundreds of these beautiful creatures arose, resembling falling silver dollars flung into the



FIG. 158. — WILLET.

legged stilt, sandpiper, and the sanderling. Occasionally the shy and rare willet would rise (Fig. 158), or the ruff, famous for its pugnacity. In this interesting throng



FIG. 159. — HUDSONIAN CURLEW.

were the black-necked stilt and several phalaropes — delicate, dainty little creatures, active on the wing, and among the most beautiful of this vast throng.

One of the largest of these birds is the long-billed curlew (Fig. 159), which I have found on the dry mesa, two miles from the Pacific, at Santa Monica. They were so actively engaged in picking up grasshoppers that by keeping behind my horse and walking in a constantly decreasing circle I came within a few yards of them, and had an excellent opportunity to watch them.

The famed woodcock, now so rare in this country, and in such demand by epicures (Fig. 160), belongs with these birds, and might be called a snipe of the



FIG. 160. — WOODCOCK.

woods. Its habits are very interesting. At night it is known to take remarkable spiral flights, going through many pe-

cular gyrations. The nest is very cleverly placed, and the mother has been seen flying off with a small young one between its feet. In all, there are over one hundred species of these interesting long-legged birds, from snipes to godwits and beyond.

SOME SCRATCHING BIRDS

A familiar sight in any backyard is the common hen. Scratching violently, throwing the soil behind her, and clucking vigorously, she utters words, notes, or calls which are readily understood by her young. This habit of scratching is so pronounced that it has given the name to a large and very valuable group of birds, including the fowls, partridges, turkeys, grouse, and many others. They are all comparatively poor flyers. They have short but strong bills, powerful feet, and claws adapted to overturning the earth.



FIG. 161. — SCALED PARTRIDGE.

The partridges (Fig. 161) are familiar examples, included in a family having one hundred or more species of attractive birds of small size, found in almost all parts of the world. They prefer the ground, and will run a long distance rather than fly. When hard pushed they rise and move with extreme rapidity, accompanied by a loud whir-

ring sound that has demoralized many a novice with the gun.

The California valley partridge is one of the most attractive, having upon its head a tuft of feathers which gives it a jaunty appearance. It is found in California in vast flocks, especially in the highlands near the mountains. It is a social little creature. As I write I can hear its sweet call in the arroyo, not a gunshot distant. It forms its



FIG. 162. — BOBWHITE.

nest beneath the cactus or brush, and when discovered often rushes away with drooping wings, pretending to be wounded, to attract attention from its nest or young. Another attractive species with longer plumes is found in the mountains.

Bobwhite (Fig. 162) is one of the best-known game birds in America ; it is found in

flocks among the grasses, its note sounding like the name. It is often called quail or Virginia partridge. Equally important as a game bird is the prairie hen (Fig. 163). It is a large bird, mottled, with a short tail, having upon the sides of its neck a tuft of ten or more stiff feathers, beneath which is a bare spot capable of inflation. In spring, numbers congregate, uttering remarkable booming sounds which can be heard a long distance.

The ruffed grouse (Fig. 164) is another large member of the group, the male of which produces an extraordinary drumming noise by beating the air rapidly with its wings. The scaled partridge, dusky grouse, Canada grouse, willow partridge, and prairie sharp-tailed grouse are others of this interesting group

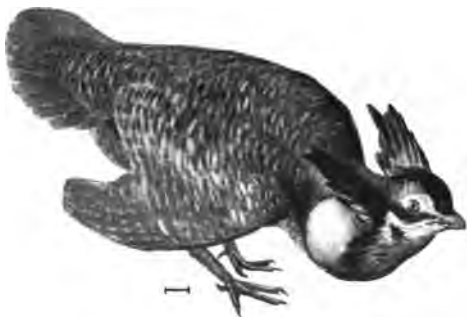


FIG. 163. — PRAIRIE HEN.

of birds which afford sport and game for thousands of hunters in various parts of the United States. The



FIG. 164. — RUFFED GROUSE.

nest of these birds are very deftly concealed, and are more often found by accident than by vigorous hunting. In the winter some of this tribe show a decided change of color, appearing in a garb of pure white. This is particularly true of the ptarmigan, whose plumage varies with

the seasons. Others change but little, and are readily seen upon the snow. In China is found the smallest of the

family, a creature so minute that years ago it was sold for a very singular purpose, wealthy Chinese using them as hand warmers, holding the dainty birds in their hands.

The wild turkey (Fig. 165) is the largest of the scratchers, a noble bird becoming rarer every year, but so thoroughly



FIG. 165. — WILD TURKEY.

domesticated that it is in no danger of becoming extinct. The pheasants are among the most beautiful members of this group of birds. The argus pheasant (Fig. 166) is one of the most gorgeous creatures possible to imagine, its wing and tail feathers being covered with striking eye-spots in browns and neutral tints. The bird itself is not much larger

than the ordinary fowl, but its splendid plumage gives it a length of five and a half feet and an appearance of large size. The impeyan pheasant (Fig. 167) is a resplendent creature, ornamented with a brilliant array of bronze tints which in the sunlight glisten and glow like real metal.

If the ordinary peacock (Fig. 168) was not so common, it would be the wonder of the world in its display of gorgeous plumage. The white peacock is equally beautiful, while the common guinea hen (Fig. 169) is a very attractive bird. All these birds have voices that are intensely disagreeable, especially that of the peacock. The male is the more beautiful. The female of all the pheasants is a demure bird, generally garbed in inconspicuous browns, a strange contrast to the proud, resplendent, and vain-glorious male, which in the peacock and turkey typifies the sum of vanity.

The Chinese pheasant is one of the most beautiful of all birds, bearing among other colors a fiery yellow difficult to describe in its many hues. Pheasants have been successfully introduced in America, particularly in Oregon and Washington.

Among the scratching birds none are more remarkable



FIG. 166. — ARGUS PHEASANT.

than the so-called mound builders or brush turkeys of New South Wales. The mottled tallegallus is almost as large as a turkey and resembles this bird to some extent.



FIG. 167. — IMPEYAN PHEASANT.

Strangers traveling through the country have been astonished at the singular mounds found in various places, formed of vast accumulations of refuse, seemingly thrown up by human hands. They are really the nests of these

peculiar birds, which hatch their eggs in incubators instead of sitting upon them. The mound (Fig. 170) is formed in the spring and is of pyramidal shape, the birds making it by standing with their backs to the place selected and hurling refuse at it, which they grasp in their powerful feet, so that they not only scratch, but throw. Some of the heaps are four feet in height. The mass soon ferments, producing heat, and in it the eggs of the birds are laid. They are covered

up fifteen inches deep, being placed in a circle nine or ten inches apart, an opening being left in the center as a



FIG. 169. — GUINEA HEN.



FIG. 168. — PEACOCK.

sort of ventilator to govern the temperature. Here they lie, the birds sometimes uncovering them on very warm days, for thirty days, when the young appear. The latter remain in the mound for about twelve hours after they are

hatched. On the second night they return in care of the male, and in three or four days are able to fly and care for themselves.

The nest or mound of the ocellated leipoa of Western Africa is made of fine gravel mixed with grass and leaves.



FIG. 170. — BRUSH TURKEYS.

One has been measured that was forty-five feet in circumference and almost five feet in height. The temperature in the center was 89° . Even larger than this are the mounds of the megapodius of Australia, some of which measure one hundred and fifty feet in circumference and are twenty feet in height. Some of these large mounds are the result of continual work during a number of sea-

sons, the mounds growing a little under the yearly system of repair.

Even more remarkable are the habits of the interesting maleo, found in the island of Celebes — a bird which can almost be compared to a turtle. In appearance the bird resembles the guinea fowl. In August or September the male and female dig a hole four feet in the dry volcanic sand of the seashore. There a single reddish egg of remarkable size is laid. About two weeks later the bird returns, and another egg is deposited, until six or eight have been laid, several hens using the same nest. The eggs are then deserted, the heat of the sun hatching them. The young birds break the shell and crawl upward like turtles, when they are able to fly immediately and care for themselves. Allied to these are the strange curassows.

The pigeons well illustrate what man can do by selection. All the wonderful varieties — pouters, fantails, barbs, and others — are but mere variations of the wild pigeons. Of all these, the carriers are the most interesting and valuable, possessing the homing instinct remarkably developed. Mr. Otto Zahn of Los Angeles trained his pigeons so that for several years they constituted the telegraph system between the island of Santa Catalina and Los Angeles, a distance of thirty miles. When any one wished to send a telegram, a bird would be selected, and the message, written on very fine paper, was wrapped in tin foil about its legs. Then with two other birds it was released. The distant mainland was often hidden by fog or cloud banks, but the birds would rise upward to a height of fifteen hundred feet, then take a straight course for Los Angeles, inspired by their marvelous and unerring instinct.

They would reach the city in about an hour. As they alighted on the platform and entered their coop, an electric signal was sounded in the adjacent house. The owner came out, released the paper, telephoned the message to the telegraph office, and then fed the birds. The birds were returned to the island the day following on the steamer. To perfect this system, two flocks were main-



FIG. 171. — DODO.

Extinct.

tained, one at Santa Catalina, that had lived in Los Angeles, and another in Los Angeles that recognized Santa Catalina as its home.

The famous dodo (Fig. 171), which became extinct within historical times, was a gigantic pigeon in-

capable of flight. It lived upon the island of Mauritius and was as large as a swan, having a large, hooked bill and rudimentary wings.

There are over three hundred species of pigeons and doves found in different parts of the world. Many of the doves are very beautiful. They have one habit which marks them as peculiar. Nearly all birds when drinking insert the bill, take a very little water, and holding the bill upward, let the liquid run down the throat; but the pigeons and doves plunge the bill into the water and drink

like other animals. Some make a peculiar whistling sound as they fly, and the notes of many are very mournful. The passenger pigeon (Fig. 172) is one of the most interesting of the group, existing in such vast numbers early in the nineteenth century that flocks of them often darkened the sun. How many birds were included in these flocks is not known, but it is



FIG. 172. — PASSENGER PIGEON.



FIG. 173. — MOURNING DOVE.

estimated that a single flock contained as many birds as there are people upon the globe. Wilson estimated one of these flocks at two trillion birds; and gave it as his opinion that they consumed seventeen million bushels of corn a day. A famous roosting place was on Green River, Kentucky; and Audubon has described the sight as they arrived, breaking down the branches of trees and creating a deafening, roaring sound. To-day the passenger pigeon is almost extinct.

The mourning dove (Fig. 173) is an interesting form. As I write, a pair resting in a eucalyptus tree near my garden are uttering their loud and mournful call, "coo-coo-o-o." The nest is in almost every instance poorly made, a few

twigs being thrown together in a most careless manner. Perhaps the handsomest birds of the tribe are the crowned pigeons of New Guinea, which are of a rich blue tint, with a remarkable set of plumes upon the head, giving them a most fantastic appearance. The feet of the doves and pigeons are small. These birds are valuable agents in transporting seeds from one part of the country to another. Pigeons have been killed in New York State with fresh rice in their crops which must have been obtained seven hundred miles away in Georgia. When the Dutch destroyed the nutmeg groves on all the East India islands except Great Banda, they found that the pigeons carried nuts to the various islands faster than they could pick them up and destroy them.

BIRDS OF PREY

The dove, of all birds, forms a sharp contrast to the fierce birds which live by preying upon others, dead or alive. The very appearance of the hawk or eagle suggests rapine. The eye is fierce, the beak is powerful and curved (Fig. 174), and the claws (Fig. 175) are sharp and capable of grasping prey and holding it with a most tenacious grasp.



FIG. 174. — HAWK'S BEAK.

They are rarely amenable to kindness. I have had several sparrow hawks which I attempted to tame. They fed from my hand, but were always ready to turn on me. A condor was more amenable, allowing me to scratch its head; but a so-called pet,

a monkey-faced owl, never failed to strike at me with its terrible claws, all the while uttering a diabolical asthmatic sound.

The visitor to Charleston, South Carolina, will be interested in the turkey buzzards (Fig. 176), which are protected by law and are the scavengers of the city, eating all the refuse thrown them, an altogether disgusting bird, yet valuable in warm countries. Their sense of smell is wonderfully acute. In Southern California dead or dying ani-

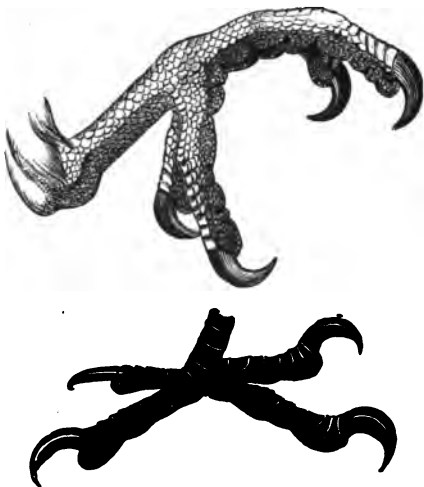


FIG. 175. — CLAWS OF HAWKS.



FIG. 176. — TURKEY BUZZARD.

mals can always be found by watching the buzzards, which can detect seemingly the slightest evil odor.

The South American condor (Fig. 177) is the largest of all flying birds, specimens having been seen, according to Byam, with a spread of wing of fifteen feet. This splendid bird makes its home in the Andes, and is often seen high in air over the loftiest peaks. It doubt-

less ascends to a greater altitude than any other bird. Its flight is graceful, a marvelous spectacle of balancing and soaring, the bird moving for hours without perceptible motion of its wings. Its powers of vision are so remark-



FIG. 177.—SOUTH AMERICAN CONDOR.

able that it can recognize animals at a long distance. Its nest is built of twigs and sticks on some inaccessible cliff. Closely resembling this bird is the California condor, formerly common from Sacramento south. I have seen it

roosting on the oaks of the San Gabriel valley, near Pasadena, and its nest has been found near the canyon of Santa Monica.

Of the European vultures the lammergeier is the largest, having a spread of wing of eight feet. Many stories are told of these birds carrying off animals and children. They are unable, however, to hold large objects in their claws, as are the eagles; but several



FIG. 178. — BLACK VULTURE.

large California vultures have been seen to drag a young grizzly bear several hundred feet. The black vulture (Fig. 178) is a common form in the Southern States and South



FIG. 179. — PIGEON HAWK.

America, being more common along the seashore than in the interior. The hawks, so far as their habits are concerned, are immature eagles, preying upon smaller birds and animals, as rabbits, squirrels, fowls, and sparrows. They have grasping claws, terrible weapons which not only grasp prey but penetrate it like knives. The pigeon hawk (Fig. 179) is a familiar form, rapid in

flight; while the duck hawk, which preys on these birds, is larger.

The American osprey (Fig. 180) is an interesting bird, always found near the water, preying upon fish, which it catches, and of which it is frequently robbed by the bald eagle. The nest is often built in a conspicuous place. I once watched a pair of these birds build a nest on Santa Catalina Island, upon the top of a derrick which was in frequent use. Near the same place were several bald eagles which systematically robbed the osprey of its hard-earned game and in turn were mobbed by the ravens for pure amusement. The fish hawk, as this bird is also called, catches the flying fishes at Santa Catalina. These fishes when chased by the insatiate tuna soar sometimes for over an eighth of a mile about a foot above water. The hawk perceives them from high in the air, and with partly folded wings, darts down, swift as a thunderbolt, stops with marvelous skill, and grasps the fish from above. Then it rises with victorious cries which attract the attention of the thieving bald eagle.



FIG. 180. — OSPREY.

The hawks are quickly recognized as an enemy by fowls, which utter a peculiar warning, understood at once by the young, which quickly run for cover. Yet I have seen a sparrow hawk so mobbed by the smallest of birds that it made every effort to escape. A hawk of this kind which I had chained to a tree in my yard created great

excitement among the mocking birds and blackbirds that were nesting in the orange trees. They gathered in groups and formed a ring or circle about the hawk and loudly expostulated against its appearance so near their young.

The falcons are interesting birds (Fig. 181) from the fact that in olden times they were used in the sport of falconry, the birds being trained to follow herons and other birds, while some of the larger forms were trained to follow antelope or deer. At least nine different species of falcons have been so trained. This sport was known as early as 400 B.C. During the reign of Edward III it was punishable with death to kill one. Kublai Kahn, in 1290, owned ten thousand falcons. In the seventeenth century the king of Persia employed them to hunt the wild boar, wild asses, foxes, and ante-



FIG. 181. — GRAY GYRFALCON.

lopes, and the sport is still carried on at Abasheher, Persia. Falconry has been attempted in America to a very limited extent.

The bald eagle, the most distinguished member of the bird tribe is a sad thief, robbing other birds and rarely hunting for itself. I once counted thirty of these fine birds in sailing fifteen miles up the coast of Santa Catalina. Occasionally they have been known to attack sheep. I have seen them pick up dead fish near my boat, easily carrying off a thirty-pound yellowtail; but I never saw

the eagle attempt to catch a living fish. I have found their nests on the summit of inaccessible cliffs. The birds are extremely vicious at the nesting time and have made



FIG. 182. — GOLDEN EAGLE.

savage attacks upon men who attempted to rob the nest. There is a nesting place near Avalon, and another on an isolated rock on the north end of the island which is added to year after year.

The golden eagle (Fig. 182) captures animals of various kinds, as hares, rabbits, and squirrels, though it will also eat carrion. Its nest is similar to that of the bald eagle, being built on the edge of cliffs out of the reach of a possible enemy.

As a rule, the stories of children being carried off by eagles are exaggerations. The golden eagle has been seen to carry off a young deer and kids and even to lift a fox. This eagle has a spread of wing in large specimens of seven feet eleven inches. That of the sea eagle is seven feet. Such birds weigh from eight to sixteen pounds.

THE OWLS AND PARROTS

Doves in their flight make a remarkable whistling sound, yet the largest owls may pass within a foot of a person's head at night and not be discovered, so noiseless is their flight. This is due to their feathers, which are plumelike, soft, and downy, and enable the large birds to approach their prey without noise. They are characterized by sharp bills and claws like the hawks, and large, piercing eyes which enable them to see at night. During the days they hide in trees, but as the sun goes down they may be seen flying across country to the fields and pastures of their choice. Skimming over the ground noiselessly, they seize rabbits with their terrible talons and carry them off.

There are about two hundred species of owls, of which the great horned owl is perhaps the most remarkable. The ordinary barn owl (Fig. 183) is a very singular creature in appearance. The monkey-faced owl of Cali-

ifornia is a strange creature nesting in the old oaks. I have attempted to tame this bird, but found it an irreclaimable savage. When I fed it, I was obliged to wear heavy gauntlets, as the "pet" would stop eating, and strike at me with beak or claw in the most ferocious fashion.



FIG. 183. — BARN OWL.

The little burrowing owl (Fig. 184) is interesting from its habits, living in the deserted caves of prairie dogs, and, in California, in the burrows of the ground squirrel and cottontail. The snowy owl is found in the north. It is often pure white, and when resting on the snow difficult to see (Fig. 185). It frequently haunts the ptarmigan fells in Spitzbergen, where, unnoticed by these birds, it easily seizes them.

The notes of the owls are uncanny and disagreeable. The barred owl has a call, "whoō, whoō, whoō, whoō," which can be heard over a mile with the wind, while the great horned owl utters a similar cry, "whōōōōōō," terrify-



FIG. 184. — BURROWING OWL.

ing to many. The hawk owl cries on the wing, while the pygmy owls which I have kept hiss violently, and

when approached bow repeatedly before taking to the wing. The eye of the black leopard has always seemed to me to be the most remarkable in its blaze of yellow light, but the huge eye of a large owl is almost as menacing.

The parrots are essentially climbing birds. They perform the most remarkable feats by means of their powerful claws, which, it will be noticed, are arranged in pairs, two in front and two behind. They have powerful beaks, like the hawks, but with one exception are not flesh-eaters, living upon seeds and fruit. They have peculiar fleshy tongues which can be moved in almost any direction, and many parrots can be taught to utter words and sentences. They have no intelligent understanding of such words, merely imitating what they hear and have been taught. But so well do many of their phrases fit to time and occasion, that it is almost impossible to believe they are not using language after the fashion of man. One which was kept in a house adjoining my own learned to imitate the mocking birds so perfectly that it was difficult to distinguish between them. It also imitated the grewsome bellow of the burro, or donkey. It caught the cries of the itinerant street dealers, and spent much time crying at the top of its voice, "Old rags, old rags, bottles, old rags."



FIG. 185. — SNOWY OWL.

In North America we have but a single native parrot (Fig. 186), the Carolina parrot, and this is very rare.

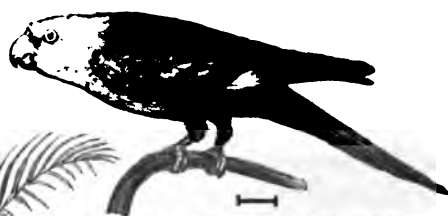


FIG. 186. — CAROLINA PARROT.



FIG. 187. — COCKATOO.

In the tropics they are the most brilliantly colored and vociferous of all birds. Over four hundred species in all are known. They range from the beautiful little paraquets, or love birds, which are successfully reared in Southern California, to the great African macaws and cockatoos (Fig. 187), that look as though they had been painted for dazzling and grotesque effect.

An interesting member of this group is the flesh-eating parrot. It is found in New Zealand, and has developed such a taste for sheep that it is being exterminated. The parrot alights upon the back of sheep, and with its sharp beak tears away at the flesh, killing the animal. At one station on the Matataahn nineteen sheep were killed in a single month by these small birds, and in another flock of three hundred and ten lambs, two hundred and five were killed in five months. The sheep owners were forced to organize against the parrots, and men were hired to shoot them wherever found.

The owl parrot of New Zealand appears to resemble both birds, having the face of an owl but the body of a parrot. It is altogether a singular appearing bird.

WOODPECKERS, CUCKOOS, ETC.

The Indians of certain tribes in California weave beautiful baskets which have a reddish, cloudy effect. Examination will show that this effect is due to the fact that the red feathers of the California woodpecker have been woven in the basket.

The woodpeckers are valuable allies to the farmer, destroying a vast number of insects injurious to vegetation.

The feet are strong. The toes are arranged two in front and two behind, so that the birds can readily climb trees.



FIG. 188. — TONGUE OF A WOODPECKER.

The bill is strong, powerful, and pointed. The tongue (Fig. 188) is long and hooked to reach into holes and crevices.

No more attractive birds are seen in the forest than the richly hued woodpeckers, running about the trunks and limbs, and tapping the bark as they move. They discover at once by the sound the lurking place of an insect or grub, and then pound the bark until it crumbles away and the grub is secured. About three hundred and fifty species of these birds are known, the flicker (Fig. 189) being one of the most familiar. In the eastern United States a striking and conspicuous form is the pileated woodpecker (Fig. 190), with a red crest and a peculiar white streak from the long, sharp bill downward. A few years ago this bird was very common, but for some reason it is gradually disappearing. The ivory-billed woodpecker is a strikingly beautiful bird found in the Gulf States with the dainty hairy woodpecker.



FIG. 189. — FLICKER.

The woodpeckers as a rule build in trees, selecting some decaying knot hole and working it out until a perfect cave in the tree is the result. Here grass and leaves are placed and the white eggs laid. In California the traveler will often notice trees and woodwork of various kinds, as the walls of houses, studded with acorns. This is the work of the woodpecker. At the entrance of Mirimar, a beautiful home at Santa Barbara, stands a large oak almost completely riddled with holes, each of which has been made to hold an acorn that has been so tightly driven in as to make it almost impossible to remove it. The theory is that the acorns contain grubs which are to the woodpecker's taste, and which can be taken as occasion demands. That the birds travel long distances to secure the acorns is shown at Mt. Pizarro, where many



FIG. 190. — PILEATED WOODPECKER.



FIG. 191. — YELLOW-BILLED CUCKOO.

acorn storehouses are seen, all the seeds having been brought from the mountains, thirty miles distant. Each acorn required this long flight, besides the labor of boring the hole the exact size.

A valuable bird to the orchardist is the yellow-billed cuckoo (Fig. 191), which destroys vast numbers of worms injurious to the trees. It is a large, conspicuous bird with

a sharp, powerful beak. The nest is a rude affair formed of twigs, and is generally placed in an apple tree. It contains three or four greenish blue eggs. When the latter is threatened, the mother bird will often feign lameness to attract attention from the nest.

The cuckoos of the Old World have a singular habit of avoiding the labor of nest building by depositing their eggs in the nests of other birds. Thus they escape the arduous work of incubation, which must be very monotonous and tiresome. The surprise of some small bird to find that it has an egg three or four times as large as its own, and that it has hatched a veritable giant, can be imagined, as the cuckoo often lays its egg in the nest of very small birds. In the case of an Australian cuckoo, the bird thus thrust upon another and innocent community appears to know that it is an interloper. As soon as the legitimate children of the nest are hatched, it deliberately bundles them out, thus securing all the food from the much-deceived parent birds. The Indian cuckoos place their eggs in the nests of crows.

An allied form is the road runner, a beautiful and interesting bird which I have followed on horseback, finding it difficult for a while to keep up with it. It runs very rapidly, always keeping to the road, and flying only when the horse is almost upon it. It lives upon lizards, eating a prodigious number, and builds its nest beneath clumps of cactus.

In Florida and southward to Brazil is found the ani, often seen standing upon cows and sheep, or clinging to their heads. They run over these animals like woodpeckers, in search of parasites of various kinds, which they

deftly remove. They are whimsical birds, and have a singular habit of tossing up the long tail and assuming queer postures. The ani is as peculiar as the cuckoo in its nest building. Instead of each bird having a nest, a number join forces and build one in which all the eggs are placed, the birds taking turns in the incubating process. This is certainly a labor-saving plan.

Bearing a close resemblance in form and feature to the woodpeckers are the kingfishers. These birds are of small size, with large heads and powerful beaks. They subsist upon fishes, which they obtain by plunging into ponds and streams. The belted kingfisher (Fig. 192) is a well-known form found in North America. It has a prominent crest and is a very showy bird, uttering a harsh cry as it rises from its plunge. This bird builds its nest in a tunnel which it excavates in a bank, the former being often six feet in length, in which the six clear white eggs are placed.



FIG. 192. — BELTED KINGFISHER.

The largest and most conspicuous of the tribe is the laughing-jackass kingfisher of Australia. In listening to the remarkable vocal sounds which it produces one could hardly believe that they came from so small a bird, the sounds being like the loud, uproarious laughter of a demoniac native. The racket-tailed kingfisher (Fig. 193) is perhaps the most beautiful, with racketlike tail feathers.

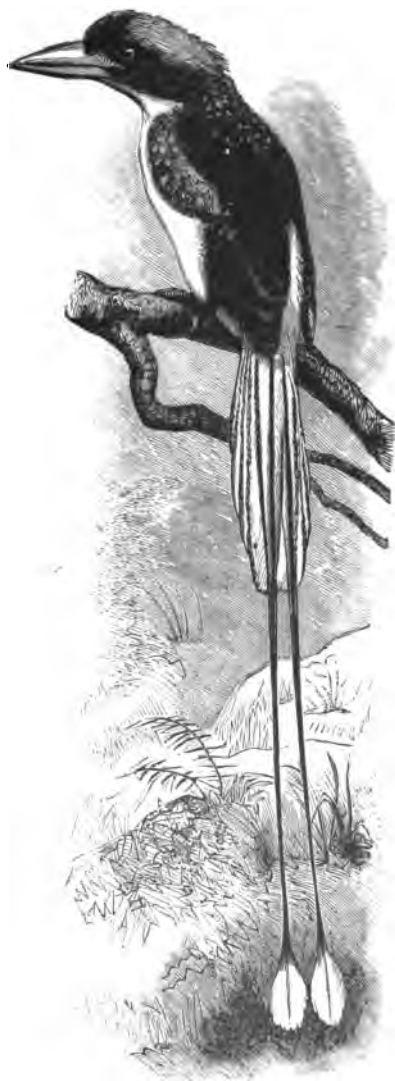


FIG. 193.—RACKET-TAILED KINGFISHER.

One of the most attractive birds, so far as brilliant plumage is concerned, found on the North American continent is the trogon (Fig. 194), a brilliant, long-tailed creature with red under feathers and coat and tail of lustrous metallic green. The tail feathers in the resplendent trogon are three times the length of the bird. Seen in the tropical forests of South America, it is one of the most gorgeous objects to be imagined. The nest is generally placed in a hollow tree, the eggs resembling those of the pigeon.

In studying birds one would naturally believe that those provided with huge and powerful bills were the most aggressive, but almost exactly the reverse holds true. The toucans (Fig. 195) have most extraordinary bills, long and heavy. So far as appearances go, they would seem to be a menace to all other birds; yet this big-beaked creature is one of the most harmless of birds,

preying only upon young birds or eggs. Indeed, so far as known there is no rational use for the huge and menacing bills except to steal young birds from deep nests. Instead of being heavy, the bill is very light and porous.

The hornbills are even more remarkable. They have a double bill filled with air cells, and in reality not the ponderous object it might be supposed, although it is ten inches in length, and the bills are serrated.

The nesting habits of this quaint bird are almost beyond belief. A tree is selected, having a crevice which is enlarged until it will hold the female.

The moment the nest is complete the male flies off, returning with mud, with which he walls up the orifice,

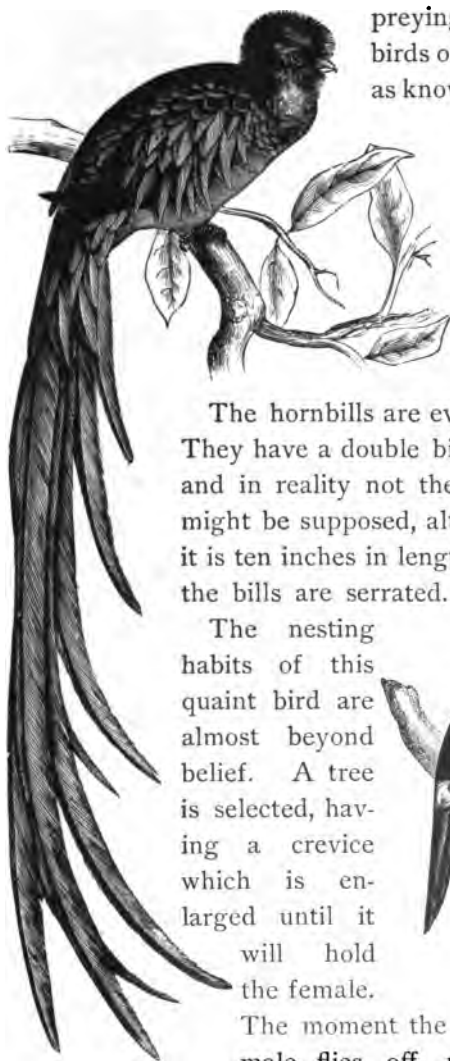


FIG. 194. — TROGON.

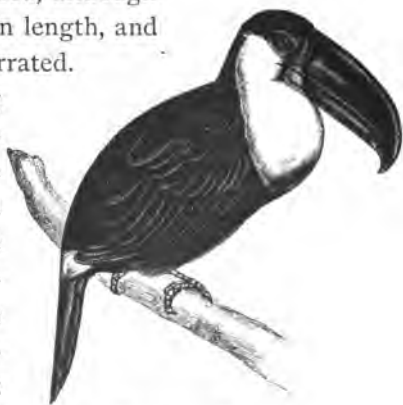


FIG. 195. — TOUCAN.

so highly valued that the business of collecting the nests is one of much importance in China. The nests are built, as a rule, on the face of a cliff, in a most dangerous position. The men who gather them are lowered down by ropes. Lives are frequently lost in this dangerous occu-

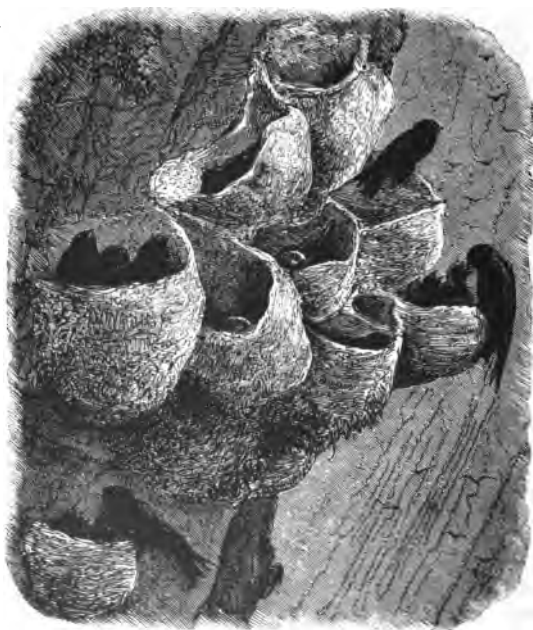


FIG. 198.—EDIBLE-NEST SWIFT.

pation. The nest building is very remarkable. The bird, having selected a site, presses saliva against the wall, repeating this day after day and week after week, adding a mere drop at a time. The saliva hardens and resembles light amber, pure at first

and attractive, but soon discolored by the birds. In this gelatinous nest the eggs are laid and the young reared. The nests are extremely valuable if newly made, and are sold in all grades of age and griminess to the Chinese, who cleanse them. In every well-conducted Chinese grocery or drug store this stock for soup can be had by the pound or ounce.

In Guatamala an interesting swift builds a tubular nest, three or four feet in length, along the face of a cliff.

The humming birds are the smallest of birds. More than four hundred species are known, all confined to North and South America (Fig. 199). The ruby-throated hummer is one of the best known throughout America, a very small, long-billed creature, the male having a splendid, ruby-red gorget. It is a common form in my garden at Pasadena, California, its peculiar hissing, chirping note being frequently heard. By planting the abutilon in the vicinity, I have encouraged these atoms until they are constant visitors, winter and summer, and they often nest in the orange trees. Here at times one may see specimens of no less than six species of humming birds. On Santa Catalina and San Clemente islands a beautiful racket-tailed humming bird has been observed.

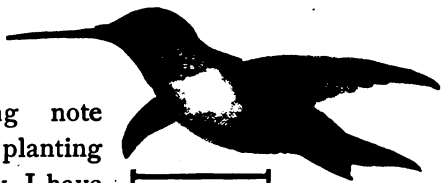


FIG. 199. — HUMMING BIRD.

These little creatures live on the minute insects they find in flowers, and doubtless suck some of the liquid sweets found there. At least a young humming bird, which I have tamed and which feeds from my hands, is very fond of sweetened water.

The birds in my garden spend at least half of their time on the wing, supporting themselves in the air when feeding. When weary they go to a certain limb or branch to rest, almost invariably selecting the same spot. They bathe after the fashion of other birds when water is provided, but the rufus often prefers to bathe in the very fine spray from the hose which I turn on. The little creature will



FIG. 200. — HUMMING BIRD
AND NEST.

sometimes dart through it, displaying great pleasure and delight. Some of these birds are so tame that I can almost touch them. The nest (Fig. 200) is a beautiful object made of the downy material from seeds and of delicate moss or the wool of sheep. I find them in orange trees, eucalyptus, and others, and they so resemble the color of the limb that it is almost impossible to detect them. Two young humming birds brought into the house

became very tame; feeding from the hand, following me from room to room, and awakening me in the morning with demands for food.

The courtship of many of these birds is a remarkable sight. The male rises upward several hundred feet, then dives down like an arrow, making a loud humming sound, to rise again. He repeats this indefinitely for the entertainment of the demure female perched on a limb hard by. The South American humming birds are beautiful beyond description, the metallic tints prevailing.

Small as are the humming birds, they are very pugnacious. Those which habitually live in my garden attempt to drive out all others. They often combine and attack large birds, especially hawks, putting these birds or even butcher birds to flight by striking them with the utmost fury. In combats among themselves, they often kill one another, dashing together like furies.

At the corner of my house a spider built a web so

strong that I found a ruby-throat completely entangled, not only caught by a web, but bound hard and fast by the big spider, which doubtless supposed that it had caught a large insect of some kind.

SOME PERCHING BIRDS

By far the largest number of birds are included in this group, distinguished for its rare singers and the individuals valuable to the agriculturist. Their feet are quite different in arrangement from those previously observed, having three toes in front and one behind. The beak is an important factor in determining the various subdivisions into which birds of this group are separated.



FIG. 201. — SCISSORS-TAILED
FLYCATCHER.

The flycatchers are familiar birds, of great variety, with broad, triangular-shaped, abruptly hooked bills. The scissors-tailed flycatcher (Fig. 201) is a beautiful creature, with a deeply forked tail and scarlet patches on the side of the body. In the king-

birds (Fig. 202) are familiar forms, while the phœbes and the peewees are all well known and well beloved by those who frequent the woods and forests. The nests of these birds are models of ingenuity, that of the kingbird being made of many different objects, and the great-crested flycatcher has a singular habit of using snakeskins which have been discarded to entwine

about its nest. The eggs of the kingbird are six in number, reddish white, with brown streaks; the male is a type of bravery, driving off the large birds, including hawks and even eagles.



FIG. 202. — KINGBIRD.

The flycatchers, as their name indicates, are very clever in capturing insects, their sharp bills being perfectly adapted to this pursuit. Allied to the flycatchers is the beautiful lyre bird of New South Wales, whose tail, in the male, in its graceful shape resembles the lyre (Fig. 203). The male of this bird builds, aside from the nest, a dome-shaped, moundlike structure upon which it poses and postures.

Of all the song birds, the skylark (Fig. 204) is conceded to be the most attractive, the type of thoroughly joyous nature. It sings as it rises high into the heavens, its melody faintly dying away with ever increasing sweetness. The streaked horned lark is often found in flocks near the seacoast and is called the shore lark.

The crows and ravens are among the birds of more than ordinary interest. Who does not remember "Grip" and his



FIG. 203. — LYRE BIRD.

"Polly, put the kettle on and we'll all take tea" (Fig. 205), and other phrases which the ravens learn to utter under skillful instructors?

The raven is a handsome bird, clothed in jet-black garb with metallic reflections. It is some larger than the crow.

When I first visited Santa Catalina Island, California, I found the ravens very common and social, watching the fishermen and

stealing fish if the opportunity offered. When the wind blew heavily, the ravens gathered in flocks and began a remarkable series of lofty tumbling, sweeping down in great curves and turning repeated somersaults as they flew. I saw this repeated again and again.

No more clever thieves could be imagined than those Santa Catalina ravens. Several would approach a brood of young turkeys; one bird would hop up and down on one side, thus attracting the attention of the mother;

then, as she rushed in that direction, another raven would dart forward and seize a young bird. In this way the brood would



FIG. 204. — SKYLARK.



FIG. 205. — RAVEN.

be depleted by the scheming and clever birds. The nests of the ravens were built on almost inaccessible cliffs.

The crow is much smaller (Fig. 206), and its "caw-w, caw-w" is a familiar note all over the country. During the day it forages for food, returning every night to the same roost, often a veritable crow city. Along



FIG. 206. — CROW.

shore the crows are very clever, opening clams by dropping them from a height. At Ocean Point, Maine, I saw them

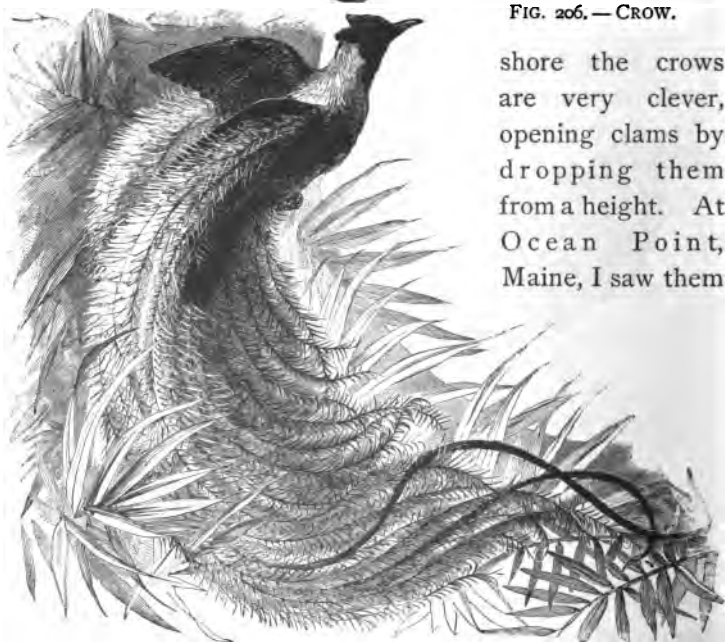


FIG. 207. — BIRD OF PARADISE.

break open echini in the same way, the rocks being covered with the shells.

Closely related to the crows are the gorgeous birds of paradise (Fig. 207) of New Guinea, whose beauties and remarkable decorations are almost beyond adequate description. The male is the more beautiful, the female being a very demure bird in a suit of brown. They fly in flocks. The emerald bird is the best known, the king bird of paradise (Fig. 208) being one of the most strangely marked. These birds were long supposed by some to be footless, but this was due to the fact that the natives invariably cut their legs off before they sold them. So for years a bird of paradise with legs was never seen.

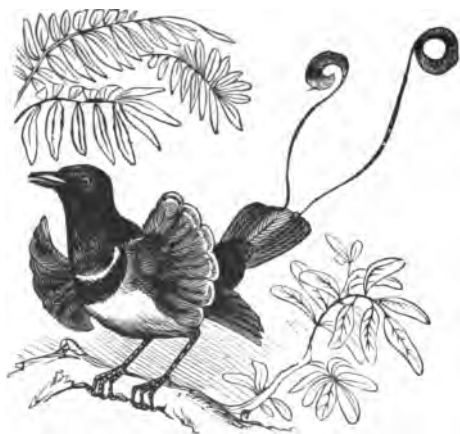


FIG. 208.—KING BIRD OF PARADISE.

The mouse birds (Colius) resemble swallows, but their feathers are so fine that they are like hair. The feet are bright red, the four toes all extending forward.

The wiriwa, as the natives term it, is found in thick vines darting in and out at times like a mouse. According to Vaillant these birds roost like bats, clinging one to the other, with the head down. They are fruit eaters.

The jays (Fig. 209) are among our interesting and highly ornamental birds. The blue jay is a large, crested

bird of much personal beauty, but of many bad habits. Its worst fault, perhaps, is that of devouring other birds



FIG. 209. — JAY.

and their eggs. It is a great mimic and rivals the magpie (Fig. 210) in the discordant notes it can utter.

Among the allied birds of interesting habits are the ox-biters, African birds resembling the star-

lings, with strong bills and hooked claws. There are several species, and nearly all have the habit of running over animals — oxen, camels, and others — to find the various insects which infest them. They have been called guardian birds, as upon the appearance of a foe they rise, uttering loud cries, thus warning the animal.

In my garden grows a tall, graceful Abyssinian banana, its leaves at least eight feet in length and a foot in width. In the spring, a beautifully colored bird, yellow and black, comes and tries to take possession. It takes a long cord



FIG. 210. — MAGPIE.

or thread from a dragoon palm in the front of the house, and, using its bill as a needle, sews in and out the side

of the leaf to the midrib until it has a cornucopia-like shape, and in this it builds its nest. In a neighbor's yard



FIG. 211. — NEST OF THE ORIOLE.

it started one in a bayonet palm, then gave it up and built another directly over it. A human being can not sew more deftly for the purpose than this charming

Bullock's oriole, so famous for its pendulous nests (Fig. 211).

The Baltimore oriole (Fig. 212) has a costume of orange-red, its head black, also the upper back and wings. The tail is orange and black.



FIG. 212. — BALTIMORE ORIOLE.

Its note is melodious and as striking as its general appearance.

The blackbirds (Fig. 213) are interesting creatures. Some nest in my garden in orange

trees, in May. The red-winged blackbird is the common form in the great swamps along the Pacific. These birds roost in the tulle swamps, and I have watched them rising at sunrise, a most interesting performance. They

appeared to be in bands of from five hundred to one thousand. At a seeming signal, a band would rise and fly away to some inland



FIG. 213. — BLACKBIRD.

feeding ground. Two minutes later, another flock of about the same size would rise, uttering loud cries. And this would be repeated until scores of battalions had gone forth for the day's work. I once saw a large drove of black pigs with one or two blackbirds standing upon the

back of each pig, and searching for pests — a work which the animals did not resent.

One of the very common birds in California, and one whose note is very sweet, is the meadow lark (Fig. 214). Its song is very singular, almost ventriloquistic.

The little cowbird (Fig. 215) has a habit similar to that of the European cuckoo; it refuses absolutely to build a nest, and deposits its eggs in that of some other bird, watching its opportunity. Some birds discover the cheat and throw the intruder out; others, again, desert the nest or build over it, refusing to be a party to the fraud.

The bobolink is one of our common meadow birds of charming song two months in the year. The male makes



FIG. 214. — MEADOW LARK.



FIG. 215. — COWBIRD.

two changes of plumage annually; in other words, it molts twice, at each time having a very different appearance (Figs. 216, 217).

In Australia we find several remarkable cousins of these birds. Notable among these are the bower birds (Fig. 218), which erect houses or bowers very much as men build ballrooms or art galleries; in a word, entirely for pleasure,

and distinct from the nest proper. The satin bower bird is about as large as the magpie, and builds its bower by



FIG. 216. — BOBOLINK.

selecting twigs of suitable size and arranging them in a plat-formlike shape. Then long twigs are selected and planted, or thrust into the ground in lines, so that the tops fall over, forming a more or less perfect arch. Thus a cabin is formed, much more complete than that made by the lowest human tribes. This is the work of the male, and is an art gallery or playhouse, pure and simple. Upon its completion, the birds from far and near bring shells, bones, twigs, and highly colored

stones, and scatter them about as ornaments. When this is completed, the birds dance and hop around and through the bower, with every evidence of delight. They pick up the various objects of art and carry them about, rearranging them with every evidence of pleasure.



FIG. 217. — MALE BOBOLINK.

Autumn.

Another bower bird makes a different playhouse, and one in the collection of the Museum of Comparative Zoölogy in Cambridge has over half a peck of decorations made up



FIG. 218. — COURTSHIP OF BOWER BIRDS.

of the most extraordinary lot of refuse it would seem possible to collect, yet all beautiful to the eyes of the birds. Most of the objects were the white shells of a snail, four hundred of these alone being counted, showing that here,

indeed, was a feathered conchologist. The rest was made up of shining stones, agates, brightly hued seeds and pods, white bones, skulls of small animals, and countless small objects which might catch the eye of a bird or a young child.



FIG. 219. — GARDENER BIRD.

Even more remarkable is the gardener bird of the island of Papua (Fig. 219), that builds a perfect hut or house, and lays out a garden simply to gratify its love for the beautiful and that of its mate. When the first white men visited this island, they heard from the natives strange stories of a bird that built such a home. They did not believe these stories, but so insistent were they that an Italian naturalist made a special search for it, and was finally repaid by finding the bird and seeing it in its house.

The latter is entirely separate from the nest. In making it, the bird selects a small tree, and about a foot from the ground attaches a bunch of moss. This is to form the support of the roof. It now selects a fast-growing orchid, and placing the large end of the twig about a foot and a half from the central tree, allows it to fall over so that the top rests upon the moss ball. Scores of others are placed side by side until a circle is completed, and we have a tent-shaped structure, an opening or door being left at one side. The orchid grows rapidly and the roof interlaces and forms a solid covering. In front of the door delicate, rich green mosses are planted until the space has the appearance of a green lawn or meadow. Finally, the remarkable bird scatters bright flowers of all kinds, which are carried away as soon as they fade and replaced by others.

THE FINCHES AND SPARROWS

Among the best-known birds are the sparrows, many of which remain all the year in the North and lend a charm to winter by their frolics in the snow. The sparrows, finches, and grosbeaks, and their cousins (Fig. 220) represent over five hundred and fifty species. Among them are some of the most charming and interesting birds found anywhere. In this group are the canary, of sweet-



FIG. 220. — VESPER SPARROW.

est melody, the song sparrow, with its wonderful notes, and a great variety of other birds.

The doughty English sparrow is, sad to relate, a well-known figure in this group. It was introduced from England, some years ago, in the hope that it would rid the trees of the canker worms, but the birds proved to be seed



FIG. 221. — SONG SPARROW.

eaters as well, and in large cities like New York have proved themselves such nuisances that they have to be killed off periodically. They have increased in a marvelous fashion, spreading over the country, many going west on grain cars, until they now have a very wide distribution in America.

They are the best known among the common birds of the garden and forest adjacent to towns and cities. The nests of these birds are often wonders of architectural skill.

The house finch, or linnet, a very common bird in Southern California, nests in the tecoma and other vines that cling about my house. They are so tame that the entire operation of nest building and bird rearing is

easily observed from the window. Under a neighbor's porch is a plant in a pot swinging by a wire; a finch has taken possession and built its nest. In my garden, which contains orange trees, palms, pines, and a number of other trees, a variety of these small birds nest, and in the spring add materially to the beauty of the garden. There are goldfinches, wild canaries, song sparrows (Fig. 221), and others. Occasionally a western evening grosbeak is seen.

The cardinal grosbeak (Fig. 222) is one of the most interesting of birds of the East or South. In Florida I found them very social. The common cage birds are splendid



FIG. 222. — CARDINAL GROSBEEK.



FIG. 223. — INDIGO BUNTING.

The buntings (Fig. 223) are interesting birds, especially the indigo bunting, with its bright blue colors. The

songsters and beautiful in appearance, having fine red crests and bills. Winter does not drive them away in the Northern States. In the trees covered with snow they present a charming contrast.

painted bunting, the lark bunting, and the blue grosbeak are allied forms of great beauty that is exceeded only in the



FIG. 224.—EUROPEAN GOLDFINCH.

goldfinches (Fig. 224), the European form of which has been introduced into America, and is now fairly common near New York and Boston. It is a welcome addition, far different from the irrepressible English spar-

row, which has preëmpted half the United States and invariably drives out other birds.

TANAGERS, SWALLOWS, AND OTHERS

One of the charming birds of the canyons of the Sierra Madre in California is the Louisiana tanager, with its crimson head, yellow body, black wings and tail (Fig. 225).

The scarlet tanager is the best known in the East, its fiery red plumage making it a conspicuous object wherever seen. Three hundred species of tanagers are known, and they are among the most charm-



FIG. 225.—LOUISIANA TANAGER.

ing and useful of all birds, enlivening forest and glade with their songs, distinct aids to nature in beautifying the world.

Almost everywhere we may find the swallows, which



FIG. 226. — SWALLOW AND NEST.

seem to be preëminently social and the companions of man (Fig. 226): They have long, slender, pointed wings, short, broad beaks, pointed tails, and very small and deli-

cate feet. Their nests, as a rule, are at the end of tunnels. Many build extraordinary mud tunnels, carrying the mud from pools in their mouths and plastering it in the desired shape. In a mud pool near my stable I have seen a flock of swallows carrying off mud to an old building, while among them were scores of mud-dauber wasps, also taking mud to carry into the same building for a similar purpose.



FIG. 227.—WAXWING.

An Australian martin builds a remarkable structure bearing a resemblance to an inverted bottle fastened to the cliff at its base. There are about eighty species of swallows, which pass much time in

mid-air, feeding on the wing, catching gnats, flies, and a variety of insects. They are all remarkable for their flight and for the vast number of miles they must traverse every day.

Among the birds of greatest beauty are the waxwings (Fig. 227). The crested waxwing, known better perhaps as the cedar bird, with its rich brown coat, and tail feathers tipped with yellow, is a familiar form in America. The peculiar red, waxlike dots on the wings make it a marked and beautiful object. In early spring I have seen flocks filling the pepper trees in California, eating the red berries with avidity, then moving on in their migration.

Among the California birds the shrikes are noticeable

(Fig. 228). They are gray-backed, powerful birds, with all the ferocity of hawks. They prey upon other birds and various small animals, and display an amount of ferocity that is almost unparalleled among birds. I noticed them particularly at the foot of the Sierra Madre in California, in the San Gabriel valley. They would dash at a bird cage when hung out, cling to it with one claw, and reach for the frightened canary with the other, sometimes securing the bird, while it



FIG. 228. — SHRIKE.

was utterly demoralized by the attack. One dashed violently at my window in its attempt to secure a bird within. They



FIG. 229. — BLUE-HEADED VIREO.

have a singular habit of impaling lizards upon the thorns of orange trees, and I have found four or five bleaching skeletons on a single tree. The butcher bird will attach bright-colored cloth or

string to the branches of trees in the same way; hence the object is not always to eat its prey. The notes of these birds are often heard in the chaparral.

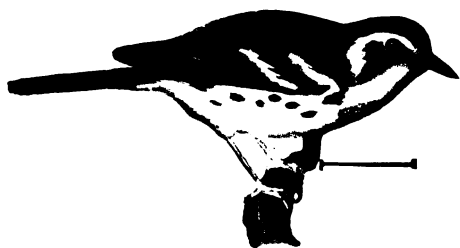


FIG. 230. — YELLOW-THROATED WARBLER.

The vireos (Fig. 229) are beautiful little creatures and with the warbler represent a large group of small but charming birds. The latter occur in seemingly endless variety (Figs. 230, 231). One hundred species of wood warblers are known. They are small but brilliant birds, loving thickets and dense shrubbery, and all insect eaters. I have noticed that they are learning to eat the peculiar scale insects, the pest of the orange grower. Many of these delicate birds fly twenty or even fifty miles to the islands off shore. I have seen several at Santa Catalina Island. The dusky and Audubon's warbler, the dwarf hermit thrush, the wren, the cedar waxwing, the shrike, the towhee, and numerous sparrows are all seemingly at home and contented in this mountainous island twenty miles off shore.



FIG. 231. — HOODED WARBLER.

One of our rarest and most melodious singers, according to Dr. Coues, is the pipit (Fig. 232). He says: "No other bird music heard in our land compares with the wonderful strains of this songster; there is something not of earth in the melody coming from above, yet from no

visible source. The whole air seems to be filled with tender strains."

Few birds are better liked than the wrens (Fig. 233). These minute and attractive little creatures are found in many dooryards. The home wren in particular builds its nest in old boxes or hollow posts provided for it (Fig. 234). The party-colored wren



FIG. 232. — AMERICAN PIPIT.

builds a beautiful cone-shaped nest which is fastened to reeds in swampy places. In South America we find the



FIG. 233. — WREN.

cock of the rock (Fig. 235), a brilliant, yellow bird with a very prominent crown or crest. The coat is so rich in color that years ago it was used to

make the official robe of the emperor of Brazil. These birds have a peculiar habit at times of forming in rings or circles, one bird at a time entering and

going through a regular performance, leaping into the air, jumping up and down, and evidently trying to outdo its predecessor.



FIG. 234.—NEST OF THE WREN.

suspended from reeds over streams in the most skillful manner, proving the weavers to be among the most remarkable of their kind so far as constructive ability is concerned. I have often watched these birds building their nests with wool and threads provided them, and the ingenuity displayed is astonishing.

The weaver birds (Fig. 236) are among the most ingenious of the feathered tribe. The oriole is a marvelous worker with its needlelike bill; but it is outdone by the weavers. The social weaver birds live in a regular bird city, a joint nest having a perfect thatched roof being often built, which looks as though made by human hands. Others are



FIG. 235.—COCK OF THE ROCK.

The strange umbrella bird (Fig. 237) has what is virtually an umbrella over its head — a large crest. Another remarkable form is the bell bird, that bears upon its head a seeming horn, its peculiar bell-like note being so pene-



FIG. 236. — NEST OF WEAVER BIRD.

trative that it is heard a long distance over the solitudes in which it lives.

Among the remarkable builders is the hanging tit (Fig. 238), whose nest is a bag-shaped structure with a perfect door. The tailor bird of India (Fig. 239) is still more striking, sewing leaves to a larger one to form a sheet or pocket, in which its nest is built and the young reared,



FIG. 237. — UMBRELLA BIRD.

swinging in the wind. Some of the South American humming birds form a similar nest, utilizing a pointed leaf, the nest so resembling the latter that it can hardly be seen.

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Closely allied is the catbird (Fig. 241). Its notes are more melodious

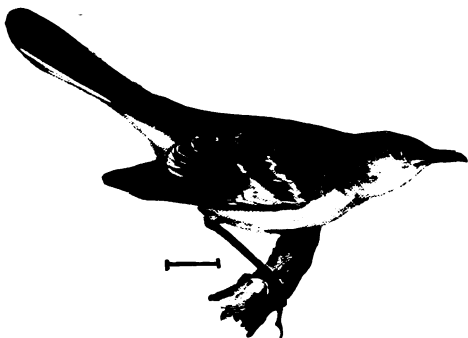


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FIG. 239. — NEST OF TAILOR BIRD.

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FIG. 241. — CATBIRD.

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FIG. 243. — ROBIN.

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FIG. 244. — HERMIT THRUSH.

of the average American in the country than this red or brown breasted little creature. Without great powers of song, it is undoubtedly the favorite bird of the masses. These birds and their cousins (the

thrushes, Fig. 244) are among the most appreciated and beloved of all the birds, and unusual efforts are being made to protect them in various parts of the East, where aliens, especially Italians, look upon them as game birds and kill them off.

BIRD MIGRATION

The birds reviewed in the present volume represent but a fraction of the vast army of feathered songsters known. Only a few examples of the most important families have been referred to, but sufficient to show that they do not lack in interest when compared with other animals. With their brilliant colors and their beautiful songs, they add to the charms of the forest and woodland and make the world more beautiful. They are also a great aid to the farmer in reducing the number of insect pests, with which the trees are well supplied. The birds have varied tastes. Some, as we have seen, are flesh eaters, some eat their own kind, others prefer tainted flesh, others insects, while a vast number are seed-eaters.

It is evident that many birds are threatened with extinction during intensely cold weather and the absence of food. The crows, certain sparrows, birds of prey, owls, and others do not mind the changes, and eke out a living in the most rigorous seasons; but the vast majority of birds recognize the approach of winter as a closed season for them, and a vast movement begins all over the country. As though a signal had been given, the birds by tens of thousands turn to the south and fly to countries where the winter is open and the food supply sure.

How birds find their way over vast wastes and seas is somewhat of a mystery; but instinct and memory play a prominent part, and from lofty heights the birds certainly remember the great landmarks. Mountain ranges, like the Rockies, the Coast Range, and the Andes, are lines of migration. So also are the great valleys and rivers, as the

Mississippi and other natural highways. The birds from the smallest hummer to the large herons and geese, fly twice a year, one of the smallest humming birds making its way from Central America to a point near the Arctic Circle.

Many of the birds fly at night, which makes their progress even more remarkable. Astronomers studying the moon have seen birds at a great height, flying across its face. The magnitude of this night migration is shown at the large lighthouses along our coasts, especially the light at Helgoland, between France and England, where on stormy nights the sight from the light is a strange one. The birds appear to be bewildered by the glare, and fairly fill the air about it. Then, as though fascinated, they plunge into it as a moth into a candle, and fall dead or dying to be picked up by scores in the morning. The lights are often endangered by large geese or ducks which crash into it. The keepers of these lights keep a record of the birds so killed; nearly all kinds are represented.

Many birds fly directly across the Gulf of Mexico from South America. This is shown by the fact that in the spring I have found warblers, rails, gallinules, herons, cuckoos, and many small birds resting in the mangrove trees at the island of Tortugas, sixty miles west of Key West. The birds would rest a few days or hours, and then continue their flight northward over the Gulf without a point in sight to guide them. In crossing the Mexican Gulf, in 1903, a number of birds came aboard ship. A flicker spent one night in my stateroom, leaving when we sighted land, and several hawks followed the ship across the Gulf, occasionally alighting on the yards.

Many birds make but a partial migration, while others fly from the tropics to the farthest North and back every year. The migrating of the small birds is not often noticed; but that of the ducks, geese, cranes, and herons is a splendid spectacle, the birds stretching out in a long line, led by a single individual.

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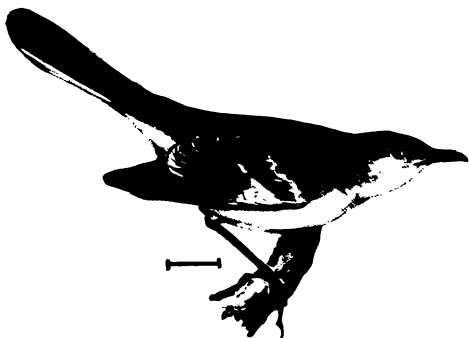


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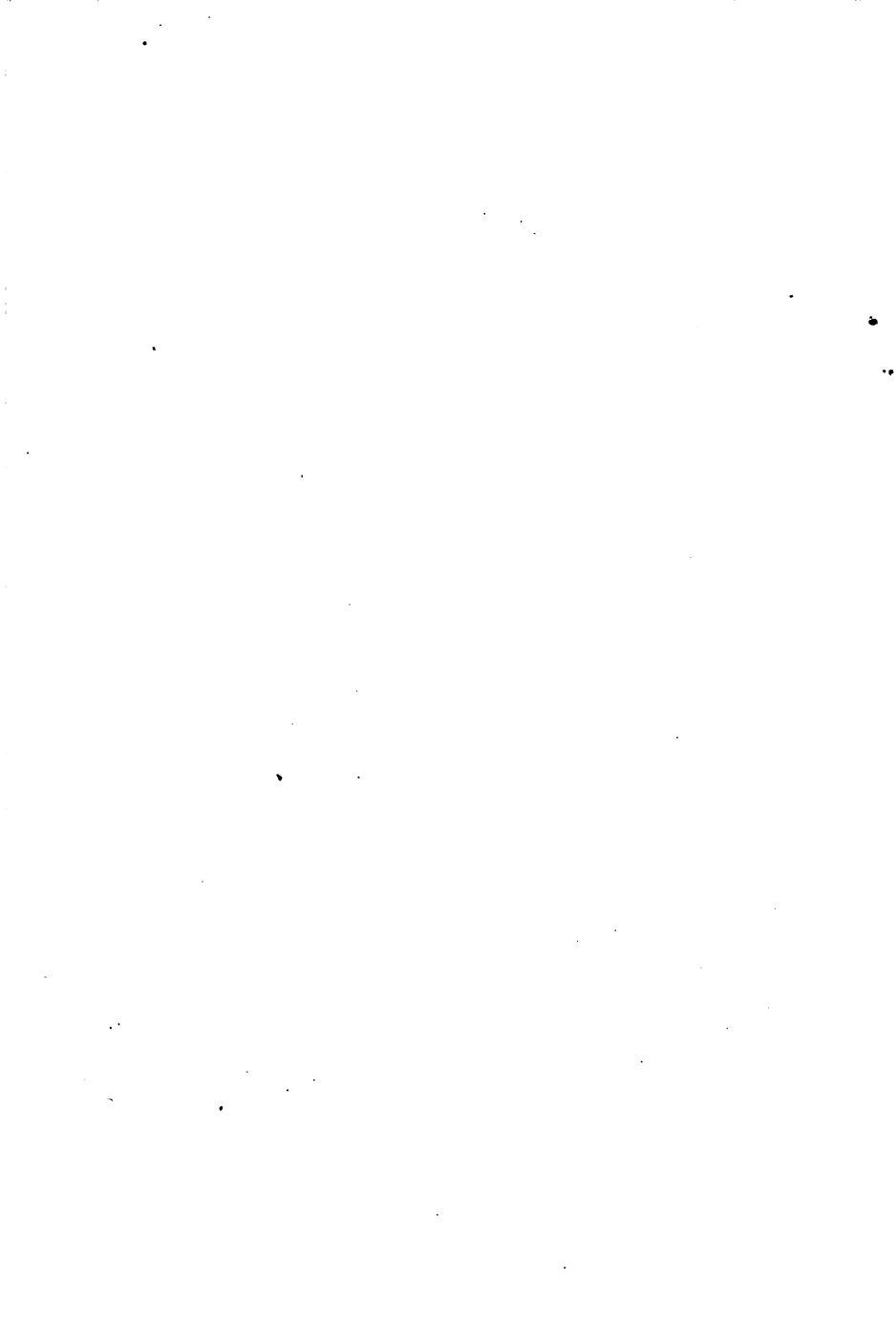
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